Smithsonian

March 1994

Rosie the Riveter
A poster icon of World War II (p. 66)

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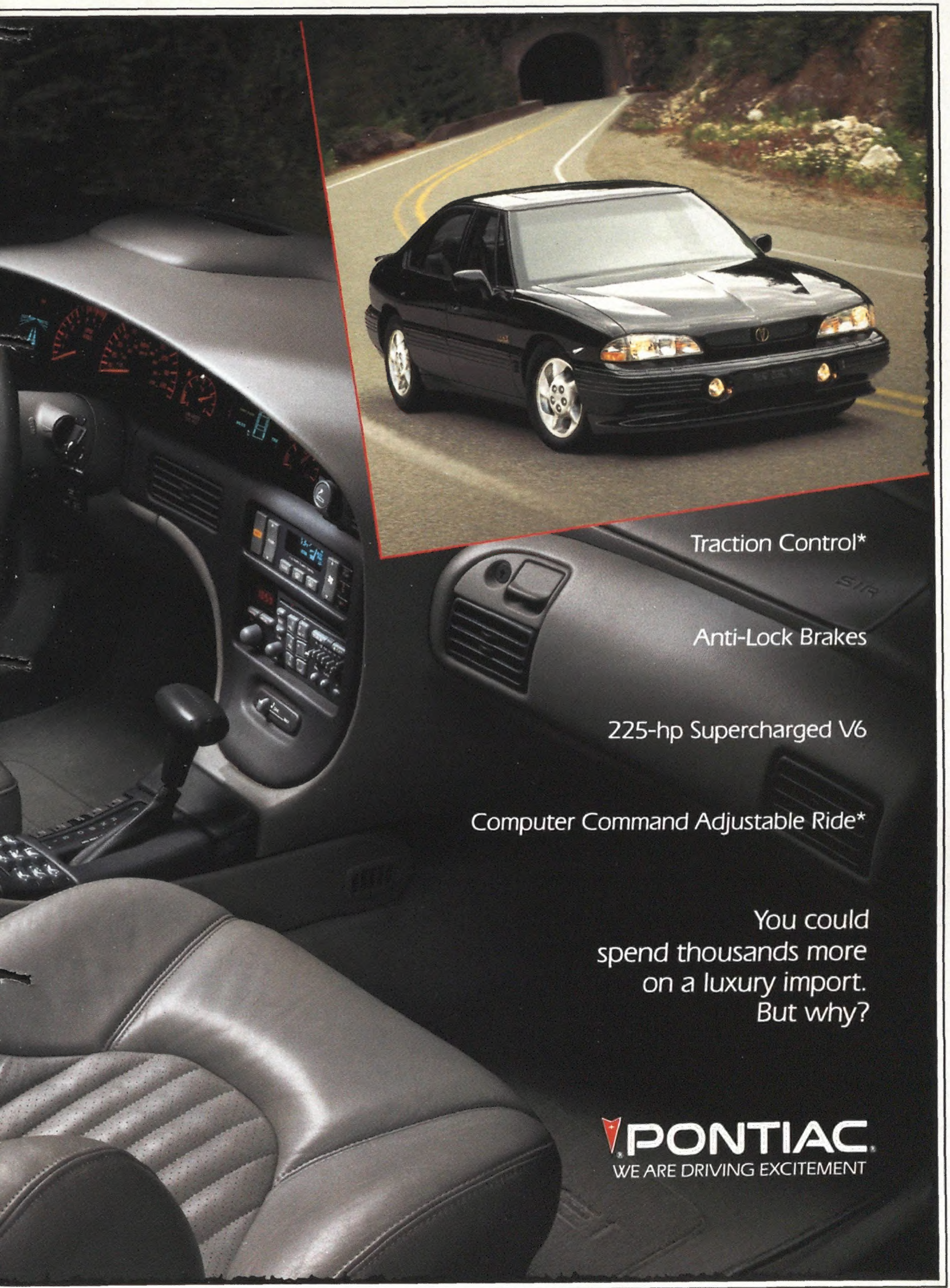
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March 1994

Smithsonian

Volume 24, Number 12

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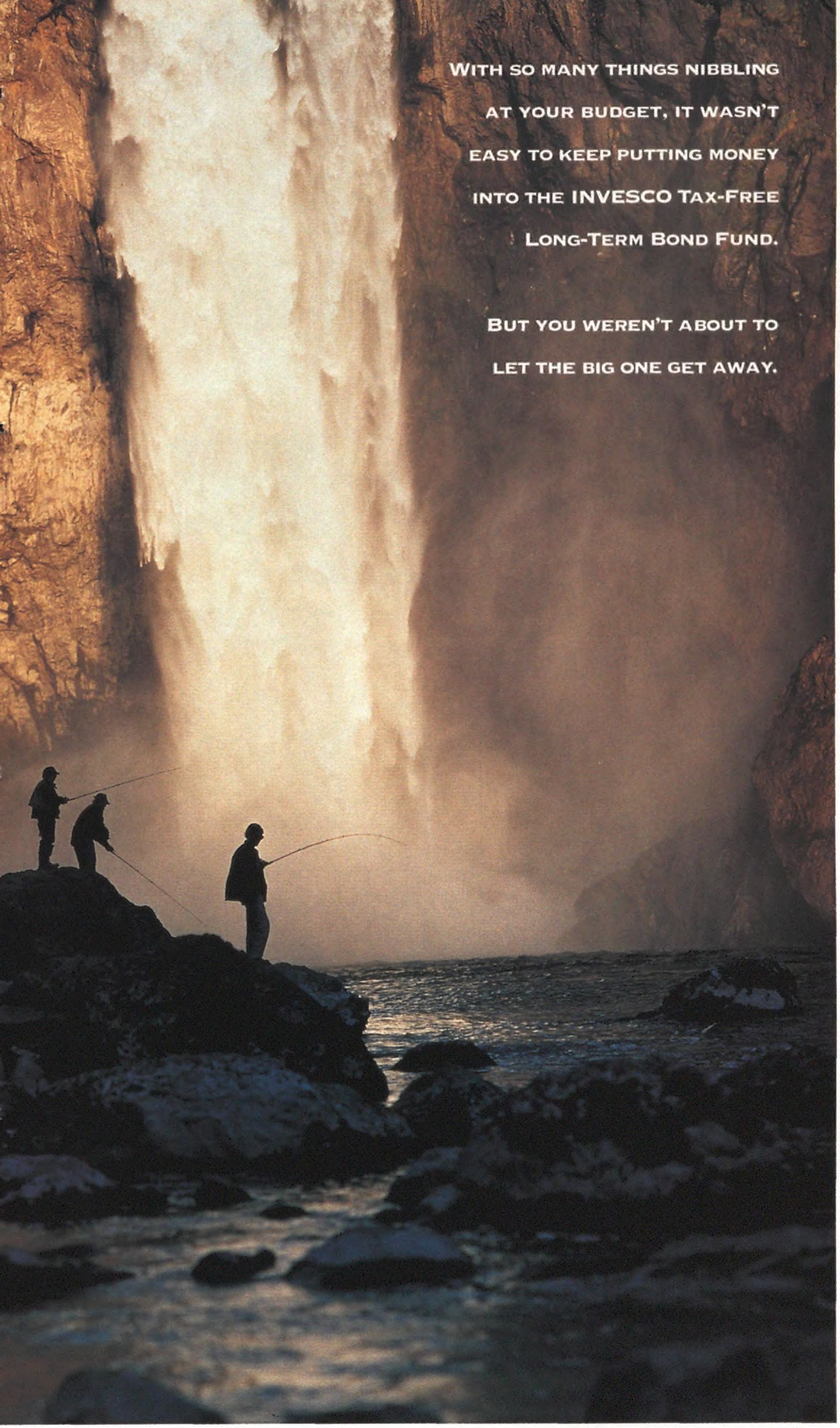
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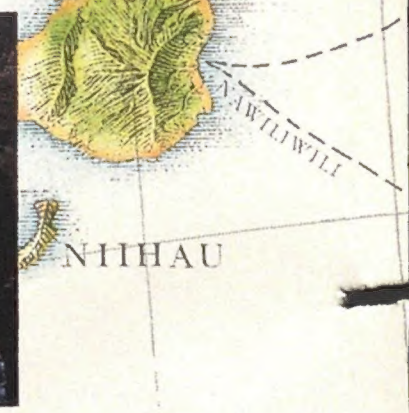

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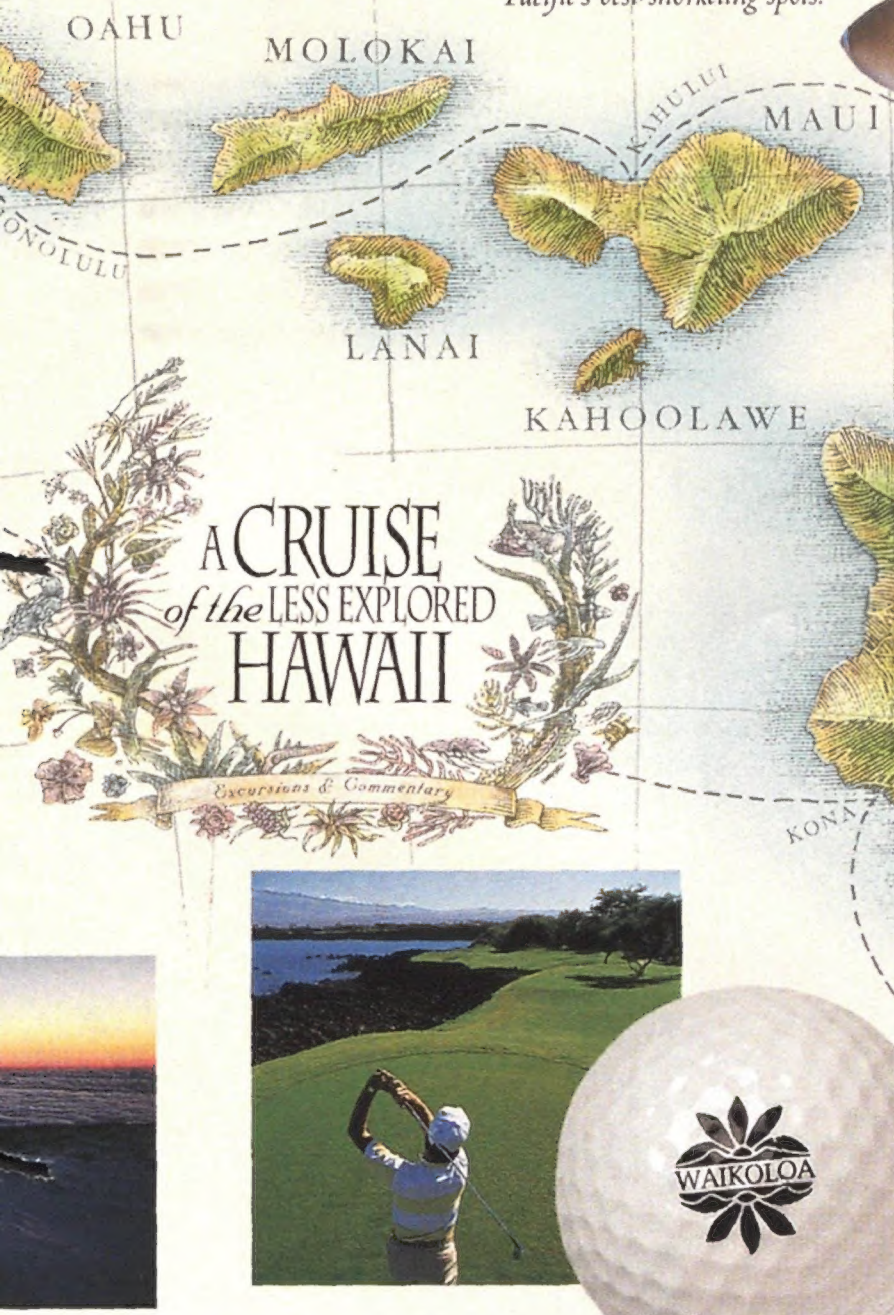

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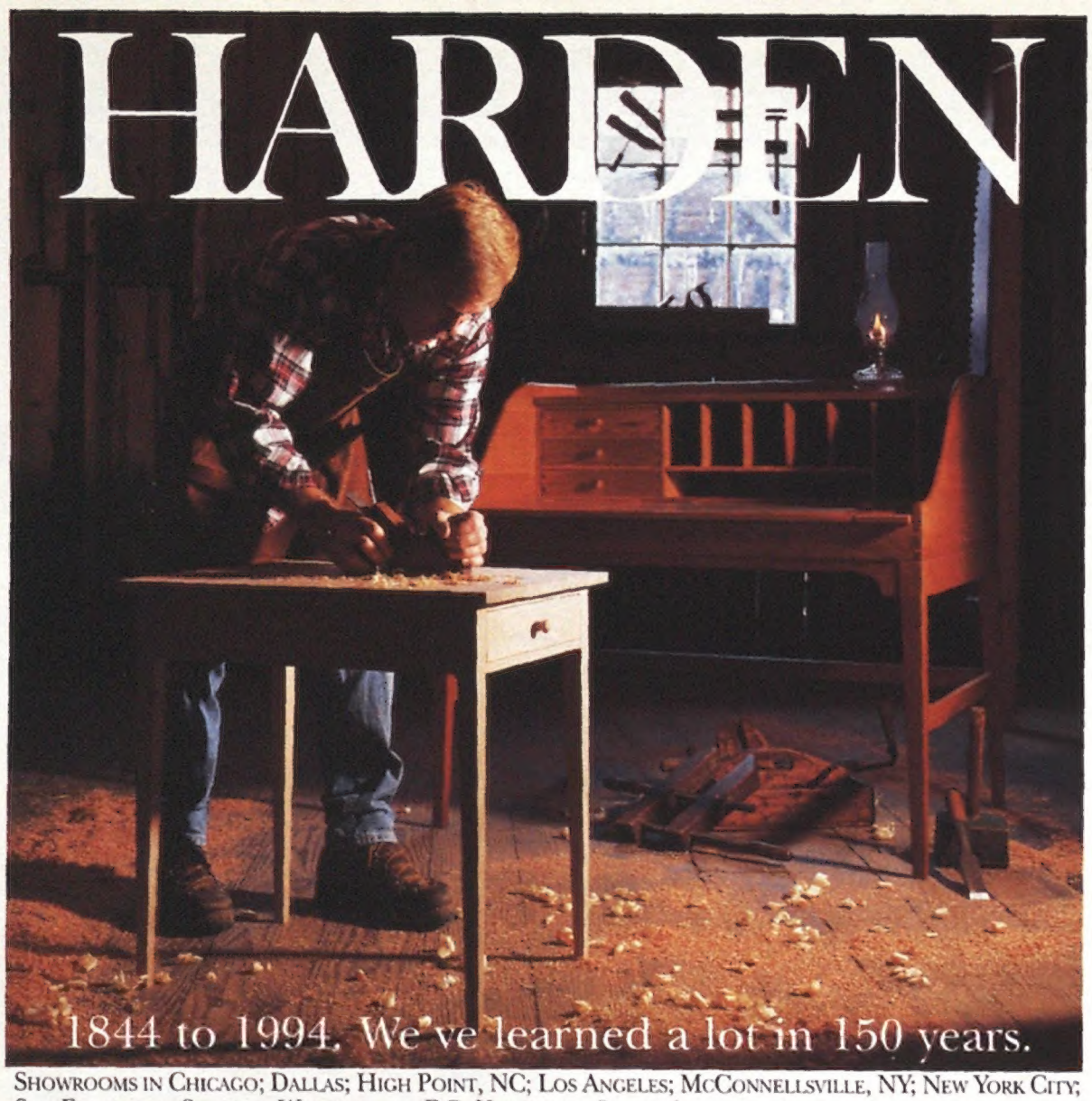

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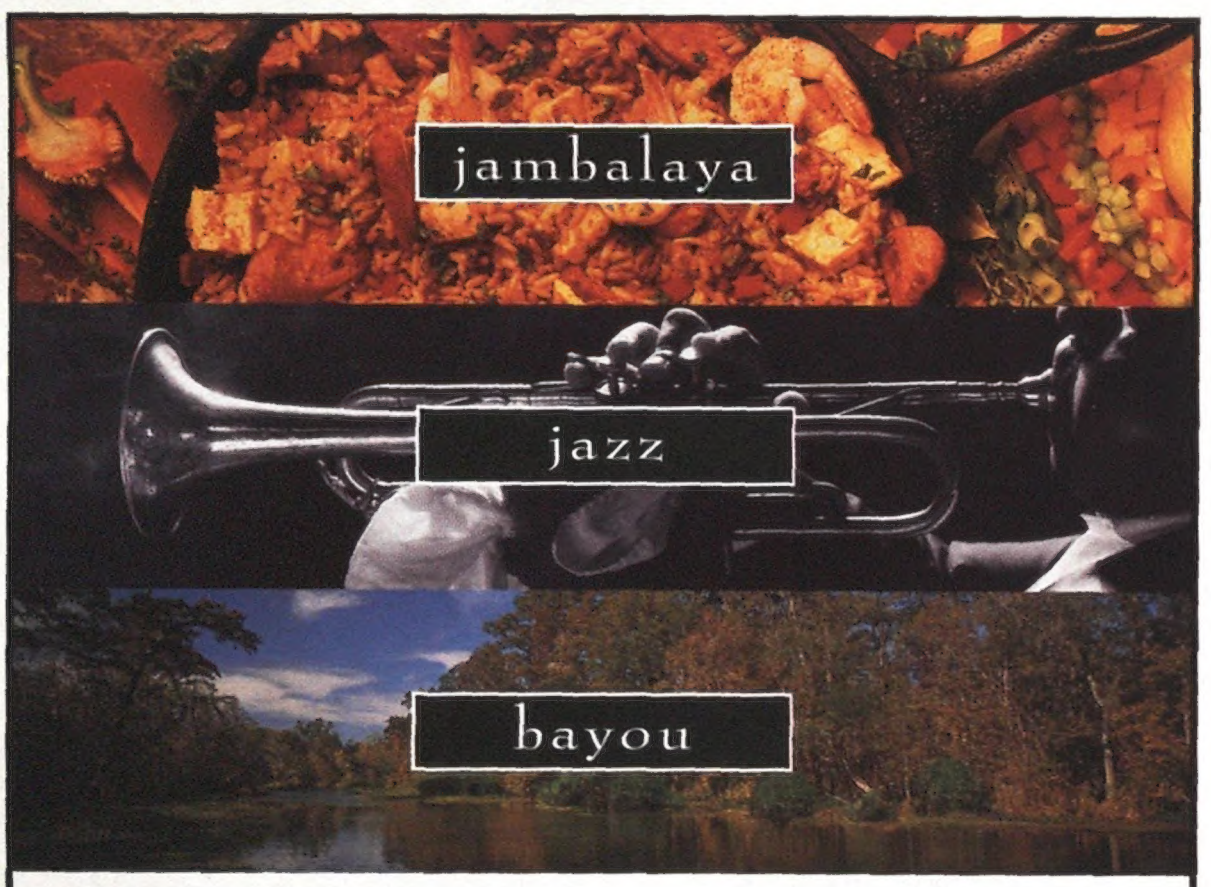

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Secretary Adams' comments

Smithsonian horizons

New findings in paleoclimatology and astronomy provide a wider context for our natural disasters

Most people, to judge from my own informal polling of public opinion, feel buffeted by what seems an ever-ascending series of natural disasters. The wonders of modern technology are seen as failing to offer timely and accurate warnings or much assistance in living through and recovering from them. Rising above the accompanying tragedy and loss on a human scale, there has been an awesome, implacable majesty about recent earthquakes, hurricanes, floods and fires. They awaken recognition of the limitations of governments, too, and reintensify our sense of attachment to older, more informal family and community networks.

However, it is not at all clear that recent events have themselves represented any departure from the ordinary in purely physical terms. More people, more widely distributed into fragile or hazardous ecosystems, cannot avoid a commensurate growth of risks. More economic development increases well-being in normal times but also means that there is more to lose. Human society erects a kind of cocoon in which to carry on its activities. We seldom take a larger view of the increasingly stressed and brittle character of our dependence on forces and resources that can never be brought securely inside the cocoon.

Yet if recent punctures of the cocoon have been relatively ordinary, scientific discovery is beginning to probe into as yet undiscovered or low-probability realms of perturbation that may pose far larger risks. My point is not that we should all be losing sleep over them, but that some consistent provision for further study would seem well justified. There is a disturbing element of choice in the risks–or opportunities, for that matter–that we recognize. And the choice is closely calibrated only to what seems already familiar, not to the probability–let alone potential magnitude–of either new achievement or disaster.

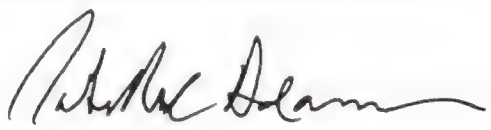
Consider asteroids. The threat that some may be on a disastrous collision course with our planet has been the subject of a recent review article in the journal *Nature.* Hiroshima-scale encounters at the outer edge of Earth's atmosphere, mostly detectable only from space, occur annually, on average. (Recently declassified data from intelligence satellites suggest the rate may be even higher.) It is calculated that there is about a 1 percent chance of an impact in the next century equivalent to a 1,000-megaton nuclear explosion, with horrible but still fairly localized devastation if it occurred in a populous area. (An asteroid of the necessary size for this passed by most recently in 1989, at less than twice the distance to the moon.) Scaled upward to 10,000 megatons or more, with some matching reduction in the likely frequency of occurrence, the possibility of global devastation and widespread extinctions (our own possibly included) would need to be reckoned with.

Unlikely as all this may appear, it can reasonably be suggested that a typical person in the United States "stands a similar chance of dying in an asteroid impact as in an aeroplane crash or in a flood," according to *Nature.* Astronomical catalogs are now thought to include less than 5 percent of the likely number of Earth-crossing asteroids. Continuing support for astronomical research would help in obtaining a fuller census.

To calculate similar probabilities on possibly devastating climatic shifts is as yet far out of reach. Possibilities of global warming as a result of added carbon dioxide and other human-generated atmospheric additives have been widely reported (*Smithsonian horizons*, September 1991), but on a longer time scale it is known that many other forces are at work. A great deal of recent scientific research demonstrates major, stunningly abrupt discontinuities in temperature–often on a scale of decades or even less–which characterized long epochs in our planet's past comparable in warmth to our own. Geographically as well as temporally, the finer resolution of recent work seems to reveal mounting dissimilarities between warming and cooling trends in different world regions, even within the past 500 years.

There is little agreement yet on natural mechanisms that might have triggered these changes. Hence no one can predict whether they might operate again in our own time. But unquestionably, the trend of research findings is carrying us away from the older, reassuring picture of a stately progression of glacial and interglacial ages that left modern society safely embedded in one of the latter. A modest, continuing investment in further, fundamental research on the exceedingly complex, metastable system that constitutes our atmosphere (its changes closely coupled with changes in ocean currents and perhaps changes in salinity affected by meltwater runoff) would seem like a good idea.

At first glance, the investigation of paleoclimates may appear to be merely "curiosity driven" science that meets no national need in a time of deficits. Asteroids, and astronomy generally, may also seem to meet no test of applicability or "relevance." But remember the self-defined cocoon in which we carry on our busy, shortsighted existence. Not only the major threats to our well-being but the greatest opportunities to assure and extend it are just as likely to lie outside as inside this supposedly protective shell that obscures our wider vision.



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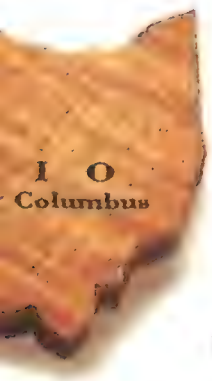

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Buckle Up! Do it for those who love you. ©1993 Toyota Motor Sales, U.S.A., Inc.

Letters to the Editor

Concrete

Dear Sir: Richard Wolkomir notes in your January issue that in World War I, the United States built a fleet of concrete transport ships. In World War II we built several non-self-propelled concrete barges for stores.
James L. Donovan
Chesterfield, Maryland

Dear Sir: From 1968 to 1980 highly reinforced concrete was rediscovered as a hull material for small boats and yachts in the 20- to 100-foot class. Using the techniques of Italian architect Pier Luigi Nervi, more than 10,000 "ferro-cement" boats were built in the United States. The vast majority are still in service. My own 45-foot ketch served me well for 17 years, and took me and my children across the Atlantic twice.

In the early 1970s, I participated in constructing ten fishboats for the Bahamian government, using native labor. Equipped with saltwater ice makers to preserve the catch, they allowed native fishermen to remain on the fishing ground for several days.

Ferro-cement boats virtually disappeared from boatbuilding yards by 1980, as no mass manufacturing method was ever developed for them.

However, the seventh annual ferro-cement canoe race, with vessels produced by engineering students across the nation, will be held in New Orleans in June.
James A. Chamblee
Clarksville, Maryland

Dear Sir: Some 40 years ago I performed and directed research into the use, in high-temperature oil well cement and in the controlled permeability of concrete, of a type of material called pozzolan. Originally discovered by the Romans, it is an amorphous silica of extremely fine particle size and was responsible for the long-lasting durability–almost two millennia–of many of their cement and concrete structures.
George B. Mangold
Benson, Arizona

Dear Sir: We are researching ways to use pieces from waste tires large and small to help prevent concrete deterioration caused by compression.

The addition of rubber as part of the aggregate makes the concrete more flexible and can significantly increase its toughness. We believe rubber may be a useful ingredient in the recipe for highly earthquake-resistant concrete.
Jerome F. Nevin
ENVIROCRETE 2000, Inc.
Bellingham, Washington

Dear Sir: The Los Angeles earthquake highlighted important features of your article, especially the necessity for more resilient concrete structures.

As I deal with systems–computers–and as concrete is a system, it fascinates me, so I am curious as to whether the five-level highway interchange pictured on your cover [below] withstood the quake.
Harding Vowles, President
Quantum Leap Expediters, Inc.
Don Mills, Ontario
According to Russell Snyder, spokesman for the California Department of Transportation, the interchange between highways I-105 and I-110, built to the latest seismic standards, suffered no damage in the 6.6 magnitude earthquake that struck Los Angeles on January 17; it remained open to traffic. In fact, none of the 122 bridges so strengthened sustained any damage. Ed.

Dear Sir: The curing of concrete–the hardening process–is not a drying process, but a chemical reaction that takes place only in the presence of water. This process keeps going on for decades, although at a decreasing rate, as long as moisture is present. Contractors should keep newly poured concrete wet for at least seven days. But all too often they pour a concrete slab, finish the surface, go off and let the sun shine on it, making it susceptible to cracking once it dries.
Walter T. Sittner
Annapolis, Maryland

Mushrooms

Dear Sir: People of Slavic descent have a traditional Christmas Eve meal, invariably including mushroom soup.

From an early age my father taught me which wild mushrooms were good and which were not. We knew when and where to look for the fungi that miraculously popped up in culm dumps, on rotted stumps and in other interesting spots in the woods of northeastern Pennsylvania. To this day, I know them all and I make at least one trip back to Pennsylvania each fall to guarantee that I'll have mushrooms for my Christmas Eve soup.
Nancy Gilbert
Stratford, Connecticut

Dear Sir: Quoting or paraphrasing 15 Caucasians and only one Asian when you say "80 to 90 percent" of the pickers are Asian-American perpetuates the myth of the monolithic "yellow peril."

Having spent more than two months following the harvest in the Pacific Northwest, I found Asian-American pickers have widely divergent backgrounds and opinions. Most are thoughtful, competent, honest, generous to a fault and often eloquent. Many decry destructive picking habits. It is well known to locals on the Oregon coast that the worst rakers, or "shredders," are local Caucasians.

But describing Caucasians as "locals" and "sons of the forest" and Asians as "foreigners" has no factual basis. According to figures released by the ranger district, only 1.5 percent of 6,000 permits were sold to local residents. As for the Asians, they are legal residents, not foreigners. Many are Hmong, Mien and Laotians recruited to fight the Pathet

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As Jim philosophized about women, I continued to sip my Baileys and coffee and read.

Between the lines.

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Lao, with the explicit promise that they could have refuge here if they lost. The Cambodians are survivors of Pol Pot's killing fields.

What about "daughters of the forest"? Most commercial mushroom hunting worldwide is done by women, a large, visible and influential minority at Crescent Lake. Many buyers were women.

Caucasian pickers were presented largely as bigots obsessed with money, but their practical knowledge of matsutake ecology impressed me. Every morning the café in Crescent Junction was a mine of information, observation and speculation on it–virtually the only subject discussed. Yet the article presents academic mycologists as the sole keepers and purveyors of fungal knowledge. Obviously your Oregon mycologist didn't look for "these dollar bills lying out in the forest." Finding them was difficult, arduous and discouraging; success required knowledge, skill, commitment and luck.
David Arora
Assistant Professor, Forest Science
Oregon State University

The Newton Boys

Dear Sir: Major contenders for the dubious honor of being our country's most successful outlaws are a more modern gang of wild Southeasterners, the Dawson Gang. Formed in the early 1970s in Muscle Shoals, Alabama, the gang is credited with robbing 100 banks, mostly in the South, of a total of $10,000,000, an average of $100,000 per bank.

Billy Ray Dawson, 14-year-old scion of a family frequently afoul of the law, was an avid admirer of the older men. Allowed to sit in during planning sessions leading to the gang's formation, Billy Ray, it was said, was a natural criminal, helping plan the robberies.

One unusual and colorful modus operandi involved an atlas that I now possess. In it, they circled the small Southern towns with a single bank. Then gang members donned jumpsuits and swooped down upon an unsuspecting community like a military operation, capturing the whole town, law and all, and neutralizing all communication with the outside. They could then rob the bank at leisure.

Eventually one or more lesser lights turned state's evidence and most primary members received long federal sentences, as did Billy Ray.
Thomas Allen
Mead, Colorado

Dear Sir: Your article glamorizes the "business" of armed robbery. Think of the message it sends to those searching for values, sustaining incomes or obtaining material status. We must prevent this country's estranged youth from becoming Newtons.
Rich Slogar
Mountain View, California

Dear Sir: My father and I met Willis Newton in our lawyer's office in Tulsa in 1953 when we purchased the land on which he had operated a nightclub. Our lawyer had told us Willis was once a train robber who had served time in prison.

He looked like a nice, old, retired businessman. Very affable, he gave each of us a jar of honey from his farm in Uvalde. His being in the honey business enhanced, for me, the image of a reformed criminal turned law-abiding citizen. But after our meeting, Dad remarked: "Willis Newton is a natural horse trader."
Clint V. Cox
Tulsa, Oklahoma

Pvt. Rosetta Wakeman

Dear Sir: In his book *From Philippi to Appomattox*, Civil War veteran and historian Orville Thomson relates that a soldier from a New Jersey regiment had managed to enlist in order to stay with her lover. She fought in four battles, serving for nearly a year. Only when she gave birth on the picket line in late February 1863 did anyone realize her actual gender.
Phillip Jackson jr.
Greensburg, Indiana

Dear Sir: The presence of American women in combat actually began in the Revolutionary War when Deborah Sampson signed up as "Private Robert Shurtleff" in the Fourth Massachusetts Regiment of Foot. She was wounded in battle and although discovered, was eventually honorably discharged and pensioned.
Jerry Blizin
Tarpon Springs, Florida

Dear Sir: Eugene L. Meyer's statement that historical revisionism "implies an ideological reworking with distinctly political overtones" is completely opposite the truth. Revisionism is an important and unending process in the writing of history, in which new information and new context are combined with previous information to create more-accurate historiography. Revisionism is often required to overturn the effects of wartime propaganda, for example, and also to define events free of any political cover-ups.

Although different groups may arrive at different interpretations of the same set of facts, ideology is not a factor.
Greg Raven
Institute for Historical Review
Newport Beach, California

Dear Sir: I write with my Brown Bess musket, cartouche box, sword and regimental coat in front of me. As a female military reenactor of the Revolution, I sympathize with Lauren Cook Burgess. I have had a lot of positive support from male reenactors, but many men and women still object and prohibit my participating at certain events.
Marjory E. Wienkop
Ewing, New Jersey

Dear Sir: Florence Budwin and her husband were serving with Union forces when captured and sent to Andersonville, where he died. Transferred to Florence, South Carolina, where she fell ill and died, her sex was revealed. She is buried in a common grave with other soldiers, a single stone as their marker.
Lewis G. Schmidt
Allentown, Pennsylvania

Smokey Bear

Dear Sir: Two of my small press' books relate to two of your January stories.

Perhaps the only outdoor statue of Smokey is a 26-foot fiberglass sculpture in International Falls, Minnesota–a faithful, authorized rendition created by Gordon Shumaker of Minneapolis and dedicated in 1954, according to our *Monumental Minnesota–A Guide To Outdoor Sculpture* by art historian Moira F. Harris.

In Stanley Karnow's piece on Chinese cuisine, credit is given to David Jung for the invention of the fortune cookie in 1916. According to professors Arthur Chandler and Marvin Nathan in *The Fantastic Fair*, Makoto Hagiwara, manager of the Japanese Tea House at the California Midwinter International Exposition, created it and served it there in 1894.
Leo J. Harris
Pogo Press, Inc.
St. Paul

Chinese restaurants

Dear Sir: Our superb Jewish delicatessen, Brothers, in Burlingame, is owned and operated by–a Chinese family.
Bruce H. Hasenkamp
Hillsborough, California

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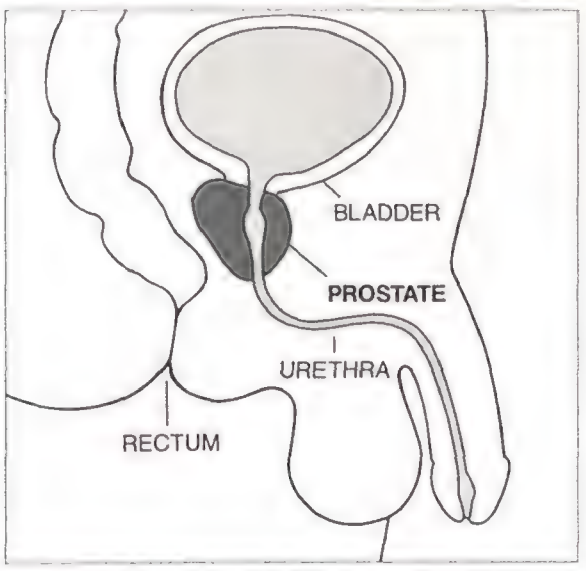
As a man ages, a key hormone can help cause the prostate to grow. PROSCAR actually blocks the production of this hormone, so it helps shrink the prostate to a smaller size in many men. As a result, some men treated with PROSCAR experience an increased urinary flow and an improvement in urinary symptoms.

Why you should see your doctor soon.

Your doctor has several options for the treatment of symptomatic BPH: watchful waiting (monitoring the condition with regular checkups), medication, or surgery. It's important to see your doctor because the problem doesn't usually get better by itself. In many cases, the prostate continues to enlarge and the symptoms may get worse. So if your urinary symptoms are bothering you, have your family doctor or a urologist assess your condition and ask if PROSCAR is an appropriate treatment for you.



The prostate surrounds part of the urethra, the tube that carries urine from the bladder. As the prostate enlarges, it can squeeze the urethra and cause urinary problems.

It is also important to have regular checkups. *While benign prostate enlargement is not cancer and does not lead to cancer, the two conditions can exist at the same time.*

Remember, only a doctor can evaluate your symptoms and their possible causes. So, if your urinary symptoms are bothering you, don't wait any longer. You may find that your enlarged prostate can be made into a smaller problem.

For more information about prostate enlargement and PROSCAR, call 1-800-635-4452 today.

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J3PO35(302)-MKP4002

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Generic name: finasteride (fin-AS-tur-eyed)

PROSCAR is for the treatment of symptomatic benign prostatic hyperplasia and for use by men only.

Your doctor may prescribe PROSCAR if you have a medical condition called benign prostatic hyperplasia or BPH. This occurs only in men.

Please read this information, as well as the leaflet which accompanies your medication, before you start taking PROSCAR. Also, read the leaflet each time you renew your prescription, just in case anything has changed. Remember, this leaflet does not take the place of careful discussions with your doctor. You and your doctor should discuss PROSCAR when you start taking your medication and at regular checkups.

What is BPH?

BPH is an enlargement of the prostate gland. After age 50, most men develop enlarged prostates. The prostate is located below the bladder. As the prostate enlarges, it may slowly restrict the flow of urine. This can lead to symptoms such as:

- a weak or interrupted urinary stream
- a feeling that you cannot empty your bladder completely
- a feeling of delay or hesitation when you start to urinate
- a need to urinate often, especially at night
- a feeling that you must urinate right away.

Treatment options for BPH

There are three main treatment options for BPH:

- **Program of monitoring or "Watchful Waiting".** If a man has an enlarged prostate gland and no symptoms or if his symptoms do not bother him, he and his doctor may decide on a program of monitoring which would include regular checkups, instead of medication or surgery.
- **Medication.** Your doctor may prescribe PROSCAR for BPH. See **"What PROSCAR does"** below.
- **Surgery.** Some patients may need surgery. Your doctor can describe several different surgical procedures for BPH. Which procedure is best depends on your symptoms and medical condition.

What PROSCAR does

PROSCAR lowers levels of a key hormone called DHT (dihydrotestosterone), which is a major cause of prostate growth. Lowering DHT leads to shrinkage of the enlarged prostate gland in most men. This can lead to gradual improvement in urine flow and symptoms over the next several months. However, since each case of BPH is different, you should know that:

- Even though the prostate shrinks, you may NOT see an improvement in urine flow or symptoms.
- You may need to take PROSCAR for six (6) months or more to see whether it helps you.
- Even though you take PROSCAR and it may help you, it is not known whether PROSCAR reduces the need for surgery.

What you need to know while taking PROSCAR

- **You must see your doctor regularly.** While taking PROSCAR, you must have regular checkups. Follow your doctor's advice about when to have these checkups.
- **About side effects.** Like all prescription drugs, PROSCAR may cause side effects. Side effects due to PROSCAR may include impotence (or inability to have an erection) and less desire for sex. Each of these side effects occurred in less than 4% of patients in clinical studies. In some cases side effects went away while the patient continued to take PROSCAR.

Some men taking PROSCAR® (Finasteride) may have a decrease in the amount of semen released during sex. This decrease does not appear to interfere with normal sexual function. Rarely, some men have reported breast swelling and/or tenderness or allergic reactions such as lip swelling and rash.

You should discuss side effects with your doctor before taking PROSCAR and anytime you think you are having a side effect.

- **Checking for prostate cancer.** Your doctor has prescribed PROSCAR for symptomatic BPH and not for cancer—but a man can have BPH and prostate cancer at the same time. Doctors usually recommend that men be checked for prostate cancer once a year when they turn 50 (or 40 if a family member has had prostate cancer). These checks should continue while you take PROSCAR. PROSCAR is not a treatment for prostate cancer.
- **About prostate specific antigen (PSA).** Your doctor may have done a blood test called PSA. PROSCAR can alter PSA values. For more information, talk to your doctor.
- **A warning about PROSCAR and pregnancy.**

PROSCAR is for use by MEN only.

PROSCAR is generally well tolerated in men. However, women who are pregnant, or women who could become pregnant, should avoid the active ingredient in PROSCAR.

If the active ingredient is absorbed by a woman who is pregnant with a male baby, it may cause the male baby to be born with abnormalities of the sex organs. Therefore, any woman who is pregnant or who could become pregnant must not come into direct contact with the active ingredient in PROSCAR.

Two of the ways in which a woman might absorb the active ingredient in PROSCAR are:

Sexual contact. Your semen may contain a small amount of the active ingredient of the drug. If your partner is pregnant, or if you and your partner decide to have a baby, you must stop taking PROSCAR and talk to your doctor. If your partner could become pregnant, proper use of a condom can reduce the risk of exposing her to your semen (discuss this further with your doctor).

Handling broken tablets. Women who are pregnant or who could become pregnant must not handle broken tablets of PROSCAR.

PROSCAR tablets are coated to prevent contact with the active ingredient during normal handling. If this coating is broken, the tablets should not be handled by women who are pregnant or who could become pregnant.

If a woman who is pregnant comes into contact with the active ingredient in PROSCAR, a doctor should be consulted. Remember, these warnings apply only if the woman exposed to PROSCAR is pregnant or could become pregnant.

How to take PROSCAR

Follow your doctor's advice about how to take PROSCAR. You must take it every day. You may take it with or between meals. To avoid forgetting to take PROSCAR, it may be helpful to take it the same time every day.

Do not share PROSCAR with anyone else; it was prescribed only for you.

Keep PROSCAR and all medicines out of the reach of children.

FOR MORE INFORMATION ABOUT 'PROSCAR' AND BPH, TALK WITH YOUR DOCTOR. IN ADDITION, TALK TO YOUR PHARMACIST OR OTHER HEALTH CARE PROVIDER.

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Around the Mall and beyond

The Postal Museum tracks the mail across old wilderness trails and into the air, while revealing a personal side of history

This was my first view of our new National Postal Museum. I didn't go to the opening last July because I've grown wary of media feeding frenzies. I'm only a writer, the guy who's always elbowed out of the way by the really important folks with TV cameras. Anyway, I'd visited the site a couple of years ago when the Smithsonian first moved the museum's staff and collection there, and I'd talked to director James Bruns about his plans. It was good to see them fulfilled (SMITHSONIAN, August 1993). The Postal Museum occupies a spectacular space within the grand old Washington City Post Office Building beside historic Union Station. Inside, a big statue of Ben Franklin, moved here from Pennsylvania Avenue, nods the way into the 90-foot-high atrium that Bruns had described to me as the museum's focal point. Three airplanes on loan from the National Air and Space Museum hang here. The earliest, a 1911 pusher based on a Curtiss design, seems to have room only for its pilot. But according to Bruns, that pilot would probably have been a performer at an air show and carried a few letters from the fairgrounds to the nearest post office. That made the letters "airmail"–sort of.

People's ignorance about early planes may explain why the famous and valuable inverted-plane airmail stamp exists. It's said that the postal clerk who sold the defective stamp had never seen an airplane. He didn't realize that this Curtiss Jenny was pictured upside down. Anyway, the stamp was released, and Jim

Bruns told me that the value of a single 24-cent inverted-plane stamp rises and falls. At the time we were talking, one was worth about $100,000.

I learned from Tom Crouch (see this column for October 1993) that airmail predates the airplane. One of Tom's books, *The Eagle Aloft*, tells of the balloon flight of the great aeronaut Richard Clayton. He rose from Cincinnati on a July day in 1835, heading for the Atlantic coast. In his cargo was a packet of mail. A huge storm grounded him near Chillicothe, 85 miles away, and he dutifully mailed the letters at a local post office. So much for balloon mail.

When I was very young–an entire era ago–we had two mail deliveries a day. They were exciting events because, aside from tedious business letters and bills that produced groans from adults, the mail always included a letter or two from family members or friends. I quickly learned to identify different handwriting, and I'd wait anxiously for a parent to slit open the envelopes and read the news aloud. Today the once-a-day delivery still contains more than enough bills.

A 1974 stamp linked Raphael's image of Michelangelo with poet John Donne's words.

The rest of it is almost all junk. Personal letters are so rare that our youngest grandson holds them gingerly by a corner. "What's this?" he asks. "It's written with a pen." This change in the content of letters is amply demonstrated in one of the five galleries that surround the atrium of the new museum; it's called "The Art of Cards and Letters," and it took me back to childhood and the reading aloud of family news.

Letter writing, I learned, is a practice better developed in some times than in others. Nancy Pope, scriptwriter for the exhibits who, with Wendy Aibel-weiss, read some 5,000 letters before determining which to display, told me that 18th-century correspondence is apt to be pretty businesslike, with personal touches thrown in as an afterthought. Also, the random spelling of that era is hard to read. But the mid-19th century was a grand time for letters. Public schooling was good enough so that many youngsters learned standard spelling. And there was plenty to write about–the Western movement, the emigration from Europe and, of course, the Civil War.

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With television still a century away, people had the time and the urge to correspond through the mail. One of the letters on display is from Narcissa Whitman. In the 1840s she joined her missionary husband, Marcus, in crossing the Rockies, settling near Walla Walla, Washington. Her letter back to her father relating her daughter Alice's death provides an eloquent sampling of both the joys and hardships of life on the frontier. Mrs. Whitman wrote that Alice had always slept in bed with her. But when the child asked to sleep beside her mother on the floor of their cabin, "I made a bed for her by the side of mine. When I used to take her into the bed with me, she would lie a little while and then wish to go back again. Thus she gradually went out of my arms to the grave, so that I should not feel it so severely as if torn from them at once."

Some settlers had come from Europe. Their letters express the awful wrench of having left home and family forever to try their luck in a new land. From New Sweden, Iowa: "You may rest assured that your letters are read with eagerness. . . . I am a little disappointed that Sister Sophia does not come. . . . We could have happy times together. But this prospect has faded since her fiance doesn't want to leave. Now I am in hopes that Johann will get the 'American Fever.'" And from Milwaukee: "I think probably none went on board with a heavier heart than I . . . but up to the present I cannot deny that there will be a better livelihood here than in poor Norway."

And so to the 20th century, when soldiers of the American Expeditionary Forces of 1917-18 went to war. One letter complains that shipments of cookies arrive as crumbs; chocolate travels better. Another pours out words of love that clumsily conceal a foreboding of death. In World War II, V-mail appeared. To save space, words were written on a special sheet of paper, which was then photographed along with lots of other letters, and the film sent overseas. There, small prints of the letters were delivered to the soldiers and sailors. Writing thus became almost telegraphic, but still there was a little room for emotion.

Today we tap out messages for electronic mail–e-mail–and send color snapshots and audiocassettes of our voices and camcorder videos of our activities via the Postal Service. Who writes an old-fashioned letter anymore?

There is no doubt that in some ways our communications have improved tremendously. The telephone is satisfactory and quick. When it has televised pictures of its users, it will bring us closer yet. The personal camcorder catches and records daily dramas and scenes. No one needs to wait for the handwritten letter. We can see and hear our loved ones and keep hourly track of their adventures.

As for the writer's craft as practiced by the letter writers of old, I sometimes wonder if it isn't becoming extinct. Not everywhere, fortunately. My good friend and colleague Jack Wiley has been writing brief essays in his *Phenomena* column, generally next door to this one, for many years. The University Press of New England has had the good sense to gather 23 of them, add Jack's introduction and an epilogue, and bring out a choice little book called *Natural High*. Jack's short, neatly chiseled pieces sometimes jolt us, often tickle us, always grab us. Through his book we again come to delight in the writer, this ever thoughtful, ever surprising, ever gentle teacher.

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Phenomena, comment and notes

Bundled against the cold, New York trio would rather catch a cab than worry about how to express a -10 degree F windchill factor in watts per square meter per second.

A rose is still a rose, but a meter isn't what it used to be–same goes for the kilogram, the second and 100 C

"Nothing to worry about. Just take half a scruple of aspirin and call me in the morning."

"Good morning, ladies and gentlemen. We are presently flying at an altitude of two leagues at a speed of 1.6 million furlongs per fortnight."

We are moving away from some of our oldest units of weight and measure. Not even pharmacists deal in scruples anymore (one scruple equals 20 grains; half a scruple of aspirin is two 5 grain–nowadays 325 milligram–tablets). The league had as many definitions as there were countries in Europe, but the most commonly accepted figure was that of the English: a league equaled three miles.

The furlongs per fortnight (improvers of the breed will know that a furlong is an eighth of a mile) is a personal favorite. The former managing editor of *Physics Today* would invoke it to persuade staffers that the units of measure chosen are, to some extent, arbitrary.

Only a few weeks ago many readers will have reacquainted themselves with the concept of the windchill factor. The rate at which heat is lost from the surface of a body depends both on the temperature itself and the speed of the wind moving over it. Everyone knows that wind makes cold worse, but it pleases to put a number on it. Almanacs and other sources provide tables with which to match wind and temperature to find the answer. When the temperature is 0 degrees F and the wind is moving at ten miles per hour, for example, the windchill factor is -22. On such a day we lose heat at the same rate we would if the temperature were -22 with no wind.

In Canada they use the same calculations to compute windchill factor, only with temperatures in Celsius rather than Fahrenheit. Canadians also use a wholly different approach, however, one that describes the rate of heat loss itself. Turn on the radio in Churchill, Manitoba, for example, and you are likely to hear the windchill expressed in watts per square meter per second.

Apparently you can calculate windchill in any number of ways. The *Encyclopedia Britannica* explains how to compute calories lost (huzzah!) per square centimeter of skin exposed per second. (A square centimeter is roughly one-sixth of a square inch.) The fomula is simplicity itself: $H = (0.14 + 0.47v^{1/2})(36.5 - T)$, where H is the calories lost per square centimeter per second, v is the wind velocity and T is the ambient temperature.

Some familiar units began as simple, if somewhat arbitrary, ideas. The foot was indeed the length of the king's foot (in France they went their own way with the *pied de roi*). A fathom (six feet) was defined by a man's outstretched arms. A sailor wanting to know how deep the water was would drop a weight on a line to the bottom, then count how many times he pulled the line through one outstretched hand to the other as he retrieved it. But how big was the king's foot, and how long were the arms of the sailor hauling the lead line?

The meter would appear indisputable, defined as one ten-millionth of the distance from one of Earth's poles to the Equator. So would the temperature of boiling water, which has always defined the 100 degrees Celsius point. The second was always a peculiar fraction of the length of a day. Alas, no more. As scientists get better and better at working with the infinitesimally small, they need more and more accurate ways to measure things. They gave up on mechanical and electronic clocks years ago, going instead with atomic clocks. Now they have stood that progression on its head, using the vibrations of atoms to define the length of a second. The second will no longer be one-sixtieth of a minute, which is one-sixtieth of an hour, which is one twenty-fourth of a day. Last May the second was defined anew as the amount of time consumed during 9,192,631,770 vibrations of a cesium atom excited by microwave radiation.

The meter has suffered an equal fate. Rather than run a string from pole to Equator, scientists had depended on two scratches (with the definitive distance between them) incised on a platinum-iridium bar in a vault at Sèvres, France. Now, however, the meter will be the distance light travels in one-299,792,458th of a second–as defined above. This is no

longer a game open to amateur players.

Starting in 1990, the boiling point of water is no longer what it was. The International Committee of Weights and Standards corrected the Celsius scale, using molecular motion rather than the properties of water for its benchmarks. Now we are to say that water boils at 99.97 Celsius.

Ah, but the worst is yet to come. Also locked up in a French vault is a block of metal that weighs exactly one kilogram. Other countries have copies, but none is precisely (and I do mean precisely) the same weight. So physicists are turning to, of all things, quantum mechanics, which to most of its fans is the very symbol of indeterminacy.

The goal is to be able to say that a kilogram is equal to the weight of so many atoms of a certain element. (How you count the atoms into a box is another matter.) To do that, they first have to find a better value for the Avogadro constant, the number of molecules or atoms in a mole. A mole, in turn, is so many grams of an element, the actual number being the atomic weight of that element. Atomic weight is a relative number: how much that atom weighs compared with an atom of another element. The atomic weight of carbon, for example, is 12.011; therefore a mole of carbon is 12.011 grams. If carbon were chosen as the new basis for the kilogram, the goal would be to know how many atoms there are in 12.011 grams of carbon.

The key to the answer is the Avogadro constant, which tells us exactly that. In the case of carbon, we would multiply 12.011 times the constant, the best current value of which is 6.0221367 times 10 to the 23d power (a 1 with 23 zeroes after it). The answer would be somewhere in the sextillions. The problem is that our current value for the Avogadro constant is just not good enough. A physicist in England is working on it. To work it out he needs a better number for Planck's constant, the fundamental unit of quantum mechanics. Light can be thought of as both waves and as discrete bundles, or quanta, of energy we call photons. The number of waves of light that pass a given point in a second is its frequency. Einstein found that the energy of a quantum is equal to the frequency of the light–multiplied by a universal constant, named for Max Planck. Its current value (to 27 decimal places) is what needs to be better known in order to define a kilogram as a certain number of atoms. As I said, someone's working on it.

Like so much of science, the weights and measures division has left the rest of us so far behind we will never again understand what is going on–or want to, for that matter. We Americans, after all, are still successfully resisting the metric system used by the rest of the world. (The Smithsonian Institution is working on this, and our own day is coming.) Sometimes we must use it, as when a field biologist turns traitor (physics envy?) and reports that the wind was out of the southwest at 5 meters per second (excuse me–is that a light breeze or a gale?).

Even many of us concerned with science live in an English-units world. It's still 90 feet to first base. More to the point, what's an inch here, an ounce there? What time does the 8:30 performance actually begin? Myself, I live in an airline world: if I arrive somewhere within 15 minutes of the appointed hour, I consider myself on time.

John P. Wiley jr.

091___001

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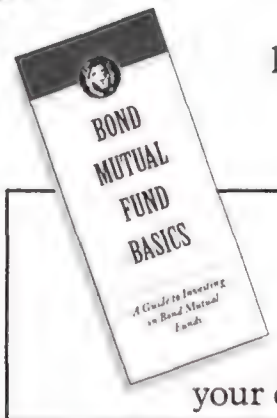

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Smithsonian highlights

Planning a Smithsonian visit?

Receive a special free Associates' Planning Packet. Write Smithsonian Information, Smithsonian Institution, Washington, D.C. 20560, or call (202) 357-2700, Monday-Saturday, 9 A.M.-4 P.M.; for callers with communication impairments, TTY: (202) 357-1729. *Note:* Parking near Smithsonian museums is limited. The convenient Metrorail subway system has parking available at some stations (details in packet).

Begin your visit at the Smithsonian Information Center's Associates' Reception Desk–open 9 A.M.-4 P.M. daily–in the Castle. The Court dining room, in the National Museum of Natural History, offers buffet service daily, 11 A.M.-3 P.M. The Castle's Commons dining room will be closed through April.

Most Smithsonian museums are open 10 A.M.-5:30 P.M. daily. Hours at the National Zoo are 9 A.M.-4:30 P.M. daily for buildings, 8 A.M.-6 P.M. for grounds.

Women's History Month

During March the Smithsonian will celebrate Women's History Month with a variety of programs. For information call (202) 357-2700, 9 A.M.-4 P.M., Monday-Saturday. For 24-hour recording, call (202) 786-2122, starting February 22.

Smithsonian Kite Festival

Kite enthusiasts from around the world will converge on the grounds of the Washington Monument on Saturday, March 26, for the Smithsonian's 28th annual Kite Festival, cosponsored by the Smithsonian Associates (Resident Program) and the National Air and Space Museum (rain date: Sunday, March 27). For information, call (202) 357-3030.

Smithsonian Craft Show

The 12th annual Smithsonian Craft Show, sponsored by the Women's Committee of the Smithsonian Associates, will be held April 14-17 in the Andrew W. Mellon Auditorium, 1301 Constitution Avenue, N.W. Ninety-four artists will exhibit and sell work in a variety of media. There will be an admission charge. Call (202) 357-4000.

Special March exhibits, events

National Museum of Natural History
From Crystal Gardens (through August) Exhibition showcases 20 specimens from the museum's collections. See *Highlights continued*, page 24.
O. Orkin Insect Zoo Newly renovated insect zoo features various insect habitats and an African termite mound.

National Zoological Park
Amazonia Permanent installation re-creates a microcosm of the world's largest rain forest and river habitat and explores its richly diverse ecosystem.

National Air and Space Museum
Patty Wagstaff–National Aerobatic Champion (March 11-March 31, 1995) Display features Wagstaff's *Extra 260* aircraft.
Monitoring Amazonia from Space (through April 22) How modern satellite technology is being used to monitor Amazonia's complex ecosystem.

National Museum of American History
Edison After Forty (through September 6) Exhibit looks at the later years of Thomas Edison's career.
Seeing is Believing: The Photography of the Civil Rights Movement (through September 11) Photographs document struggle for racial equality in the United States.

National Postal Museum
The Smithsonian's newest museum, next to Union Station on Capitol Hill, presents exhibitions tracking the history of the U.S. mail service. See *Mall*, page 16.

National Museum of African Art
Asen: Iron Altars from Ouidah, Republic of Benin (through April 24) Show explores beliefs and symbols that spread from Africa to the New World and back.

Arthur M. Sackler Gallery
A Mughal Hunt (March 13-September 11) Exhibit unlocks the identity of a 17th-century painting from India's Mughal dynasty.
Korean Arts of the Eighteenth Century: Splendor & Simplicity (through May 15) Exhibition of masterworks.

Freer Gallery of Art
America Meets Asia Newly renovated, reinstalled, galleries feature Asian and 19th- and early 20th-century American art.

Hirshhorn Museum & Sculpture Garden
Directions–Sue Coe (March 17-June 19) Large-scale narrative drawings examine issues such as violence against women.
The Collection Reviewed: Alexander Calder (through March 27) Mobiles, scupltures.

National Museum of American Art
Thomas Cole: Landscape into History (March 18-August 7) A fresh look at works by the father of the Hudson River school of painting.

Renwick Gallery
William Daley: Ceramic Works and Drawings (through April 17) The work of one of the leading figures in the history of American craft.

National Portrait Gallery
From Elizabeth I to Elizabeth II: Master Drawings from the National Portrait Gallery, London (through April 24) Portraits of important figures in British history.

Cooper-Hewitt Museum (New York)
Packaging the New: Design and the American Consumer, 1925-1975 (through June 14) Role of the designer during America's golden age of industrial design.

Exhibition catalogs

Catalogs available currently include:
Chiefly Feasts: The Enduring Kwakiutl Potlatch ($60/$29.95 paper)
VanDerZee Photographer, 1886-1983 ($39.95)

To order, send check or money order to Smithsonian Museum Shops, 8308 Cinder Bed Road, Newington, Virginia 22122. Include 15 percent of purchase to cover postage, handling (minimum, $1.75).

Smithsonian Institution Traveling Exhibition Service

SITES organizes and circulates exhibitions to cities throughout the United States and abroad. To sponsor a show in your community, write SITES, Smithsonian, Washington, D.C. 20560. March exhibits include:

• Baltimore, Maryland (March 19-May 29) *More Than Meets the Eye*, Maryland Science Center.

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Highlights continued

Flowers of the mineral kingdom

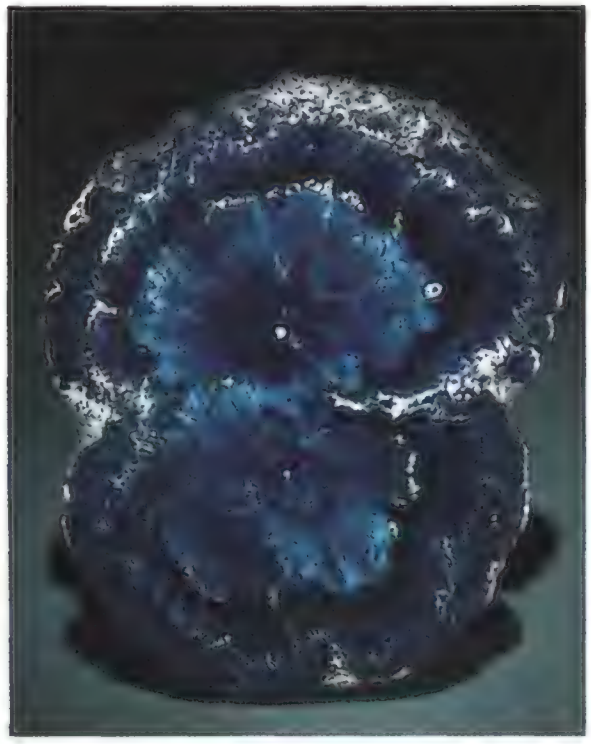
In dark subterranean gardens, watered by mineral-rich fluids, they blossom–stony branches, bristles, spikes and spines that eerily mimic living forms. They are, of course, crystals–the regular, orderly arrangements of atoms known as the flowers of the mineral kingdom. A garden of these delights is currently on display in the National Museum of Natural History's "From Crystal Gardens." The show, which runs through August, features a bouquet of the museum's most spectacular mineral specimens–from an unusual stepped "sculpture" of cubic pyrite crystals to a two-foot-high column of malachite; from cauliflower-shaped nodules of mimetite to a "candelabra" of tourmaline prisms.

Each type of crystal is characterized by its own unique pattern of atoms, the product of its chemical composition and of the environmental conditions (temperature, pressure, presence of impurities) that produced it–its nature and its nurture. "A crystal is defined by the way the atoms that make it up fit together," says Jeffrey Post, chairman of NMNH's Department of Mineral Sciences. "They grow atom by atom, as each atom locks into its appropriate position." The varied, often surprising shapes that result are not random. In fact, crystals are the epitome of order–the external manifestation of their internal structure. Each of the crystalline blossoms in the show appears just as it grew in nature. One caveat: please don't pick the flowers.
Diane M. Bolz

Rounded, yellow knobs of mimetite are actually clumps of needlelike crystals.

Water-clear gypsum crystals formed in a cavity exposed in a mine in Mexico.

This stepped configuration of cubic pyrite crystals is entirely nature's handiwork.



Internal crystalline structure can be seen in polished slice of azurite (not in show).

Sample of quartz and rose quartz, tinged pink by impurities, was found in Brazil.

"Puffballs" of mesolite needles grew on crystals of green apophyllite in India.

To Peter Gladstone, who lost his father to heart disease while in his fifties, our search for better medicines has real urgency.

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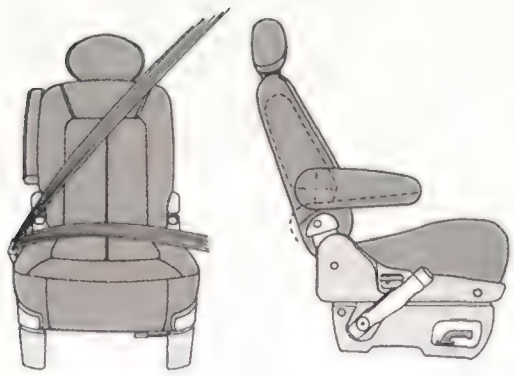
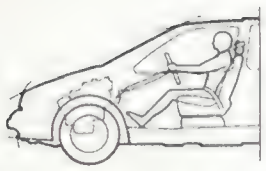
The Quest is equipped with a standard driver's side minivan airbag. Overprotective parents need protection, too.*



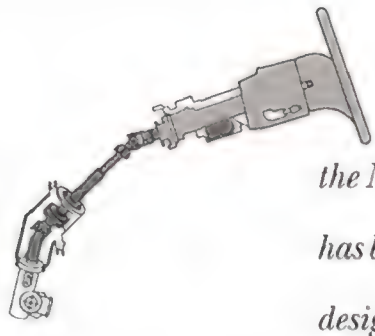
Three-point safety belts as well as head restraints are found on the outboard positions in both the second and the third rows.



The Nissan Quest features an energy-absorbing front crumple zone, strategically placed safety stops and hood buckling creases.

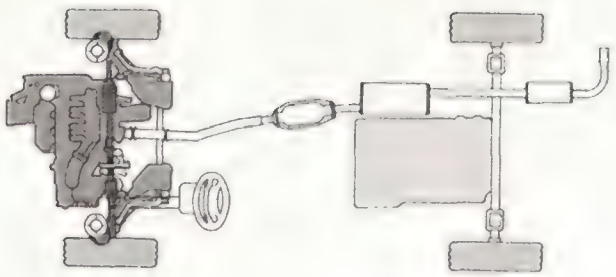
Overprotective parents

A standard 4-wheel Anti-lock Braking System on the GXE model helps maintain greater steering control during emergency hard braking.



Similar to the front crumple zone, the steering column in the Nissan Quest has been specifically designed to absorb impact energy in the event of certain frontal collisions.

*Nissan Motor Corporation U.S.A. Smart people always read the fine print. And they always wear their seat belts. *Minivan airbag can provide added protection*

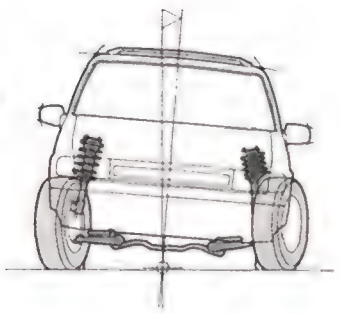


The V6, 151-hp engine rests in front, which gives added weight over the drive wheels, which gives the Quest better driving traction, which gives you added peace of mind.

In the event of a side impact collision, passengers in the Quest enjoy the added protection of thoughtfully designed steel side-door guard beams.

The sliding side door has a child safety lock to help prevent any child-induced accidents.

of the world, rejoice.



A front stabilizer bar helps keep the Nissan Quest level during cornering or lane changes.

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when used with seat belts. Nissan Quest was designed to meet 1994 Federal Motor Vehicle Passenger Car Safety Standards except models with privacy glass.

Racing for their lives, residents of Hilo, Hawaii, flee as a tsunami, in the background, breaks over a street.

By Scott McCredie

When nightmare waves appear out of nowhere to smash the land

Produced by earthquakes and exploding volcanoes, lethal tsunamis (a.k.a. tidal waves) can strike across 10,000 miles of ocean

Triggered by a major earthquake off Alaska, the 1946 event took 159 lives throughout the islands.

It is a strange and disquieting photograph. A bearded man dressed in white, walking stick in hand, is dwarfed by a block of coral (p. 30). Twenty feet high and weighing an estimated 600 tons, this coral slab had originally been on the bottom of Selat Sunda, the strait that separates Java and Sumatra. Then at 10:02 A.M. on August 27, 1883, the island of Krakatau, about 30 miles from where the photograph was taken, exploded (*Phenomena*, October 1983). Eleven square miles of the volcanic island's surface suddenly collapsed in a fiery tempest of magma and rock and boiling water, creating sound waves audible 3,000 miles away, and unleashing waves of water so powerful that they ripped this piece of coral from the seafloor and carried it over the beach and more than a hundred yards inland.

A few miles from where the coral was uprooted, at the seaside village of Merak, mountainous walls of water swamped the low-lying areas, killing all but one of the 2,700 residents. Then the waves stormed up the 115-foot-high hill behind the village, on top of which stood several sturdily built brick and stone houses. Within seconds, the waves razed them. Maximum wave height here was calculated to have been 130 feet.

The potent waves that fanned out from Krakatau in 1883, killing upwards of 36,000 people, were one of several types of waves called tsunamis. Distributing the energy released from undersea or near-shore earthquakes, volcanoes and landslides, and pulsing through the ocean like sonic booms, tsunamis are the largest, rarest and most powerful waves in all the seven seas.

Over the centuries they have spawned myths, among them the demise of the fabled city of Atlantis, and flood

A standing figure gives scale to block of coral that was ripped from the bottom of the sea by tsunamis formed when the island of Krakatau blew up in 1883. Waves killed 36,000 people on the nearby islands of Java and Sumatra.

stories passed down from ancient cultures; they have been invoked to explain Moses' parting of the Red Sea. Records from one tsunami may provide evidence for an apocalyptic event that drove the dinosaurs to extinction. Today tsunamis defy even the most sophisticated warning systems. Most Third World countries remain completely unprotected from the menace of tsunamis; some places in the developed countries, too, including a "protected" section of coast in the United States, lie exposed to their vagaries.

Tsunami is a Japanese word that means "harbor" (*tsu*) "wave" (*nami*). A Japanese name is appropriate since Japan endures more tsunami episodes than any place in the world (followed by Chile and Hawaii) because of an extremely active seismic zone that lies just offshore. Seawalls–some as tall as 30 feet and constructed of reinforced concrete–guard coastal villages in the most tsunami-prone areas.

The most recent disaster occurred just last summer, on July 12, almost exactly ten years after the previous one. Its primary victim was tiny Okushiri Island, located in the Sea of Japan off the southwest coast of Hokkaido. Japan's elaborate warning system detected a potential tsunami-generating earthquake at 10:17 P.M. Within five minutes, computers had calculated which areas were in greatest danger, and warnings were issued. But by that time it was too late. The waves, ranging in height from 10 to 35 feet, were already crashing down on the shores of Okushiri Island. At least 120 residents were killed, houses were swept out to sea and boats were shoved inland like bathtub toys. On the southern tip of the island, waves overwhelmed a 16-foot-high seawall, triggering fires–possibly by rupturing tanks of propane that then exploded.

An even deadlier tsunami pummeled Japan a century ago. On the morning of June 25, 1896, fleets of fishing boats returned to their villages from a night spent off the Sanriku coast. Sailing closer to shore, the fishermen were shocked by the devastation they saw: 10,000 houses and other buildings lay crushed and scattered; an estimated 22,000 people had drowned. When the waves struck shore, they were between 10 and 100 feet high.

One of the largest natural disasters in Japanese history, the 1896 Sanriku tsunami illustrates the probable origin of the name. Tsunamis are usually a series of less than a dozen waves that seem to suddenly appear in the shallows of a bay or harbor, as if thrust upward by some malevolent sea god. They are never seen in the open ocean. How can a wave that barely ripples the surface at sea rise to such devastating heights near shore? To understand, it helps to know what distinguishes a tsunami from the other two kinds of ocean waves, wind waves and tidal waves.

A typical wind wave develops gradually when air moving over a span of water pushes the surface of that water into waveforms. (The same thing happens, on a smaller

Seattle-based author Scott McCredie, who wrote about slugs for the February 1989 SMITHSONIAN, *says he has no desire to experience a tsunami firsthand.*

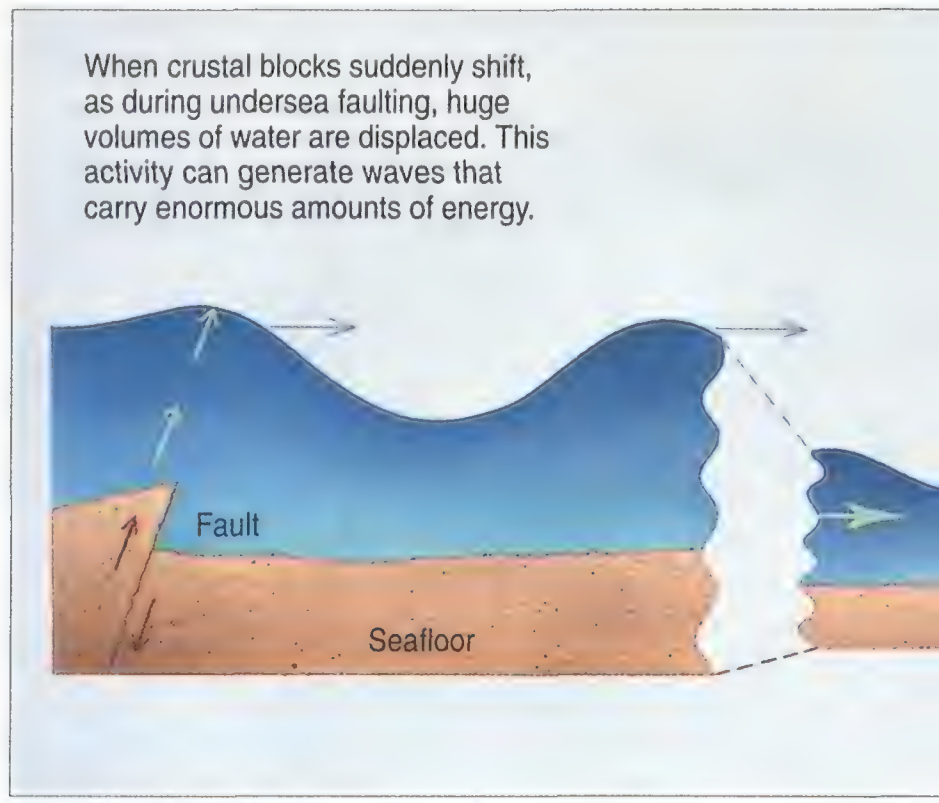
scale, to cause dry sand to form ripples on an upper beach.) The distance between waves is relatively short, up to 1,000 feet. They usually move at speeds of less than 60 miles per hour, in the form of swells that average 6 to 10 feet in height, although a full gale can produce waves of 40 feet or more and "freak" or "rogue" waves of up to 112 feet in the open ocean have been reported (SMITHSONIAN, February 1978). All the energy of wind waves is located at or close to the surface; if you were to dive far enough beneath them, you would not feel the waves passing over you.

Then there are waves that result from the tides. Most people use the term "tidal waves" to describe tsunamis, though scientists frown on this because tsunamis aren't caused by the gravitational pull of sun and moon. Still, the two are remarkably similar. True tidal waves, which sweep around the planet twice a day, are invisible in the open ocean, travel as fast as tsunamis and are characterized by great distances between the waves. Their physical appearance upon reaching shore can also be like that of a tsunami because a tsunami can assume several forms: a series of waves that break like surf, waves that appear as an unbroken "wall" of water, or a steadily rising tide-like flood. In some parts of the world, because of the topography, an incoming tide appears as a series of waves or even, in extreme cases, as a wall of water moving up a bay. The Bay of Fundy in Nova Scotia is famous for such a spectacle.

Tsunamis, on the other hand, are generated for the most part by sudden violent disturbances of Earth's crust. (That is why the Pacific Rim, the most seismically active region of the planet, generates about 80 percent of the world's tsunamis.) They are completely unpredictable–and deadly.

Plunk a stone into a pond and miniature waves will fan out from the point of impact, spreading in uniform, ever-widening circles. Now imagine that the disturbance to the water comes not from above but from below, as when a section of ocean floor rises or falls abruptly during a fault movement (pp. 32-33). The column of water

Tsunamis from a 1946 earthquake near the coast of Japan drove a fishing boat through a house in Utsumi. That nation suffers more such damage than any other and has the world's most elaborate warning system.


When crustal blocks suddenly shift, as during undersea faulting, huge volumes of water are displaced. This activity can generate waves that carry enormous amounts of energy.
Fault
Seafloor

above the disturbance can only respond by moving up or down, and this action creates a series of widely spaced waves, sometimes up to a hundred miles apart.

Unlike the case with wind waves, a tsunami's kinetic energy is evenly distributed throughout the water column, regardless of the ocean's depth. This trait accounts for the low surface height of a tsunami in the open ocean (believed to be less than three feet, though no one has actually measured one). The waves travel with phenomenal efficiency. The deeper the water, the faster they move. Tsunamis can travel 500 miles per hour through the 13,000-foot average depth of the Pacific, fast enough to tail a Boeing 747. The waves retain nearly all their energy as they traverse great distances, even across oceans, until they unleash it against a shore. As the ocean depth decreases, the energy of the wave compresses into a smaller vertical distance, just as a wind wave's energy does, forcing the tsunami to gain height and slow to between 30 and 100 miles per hour.

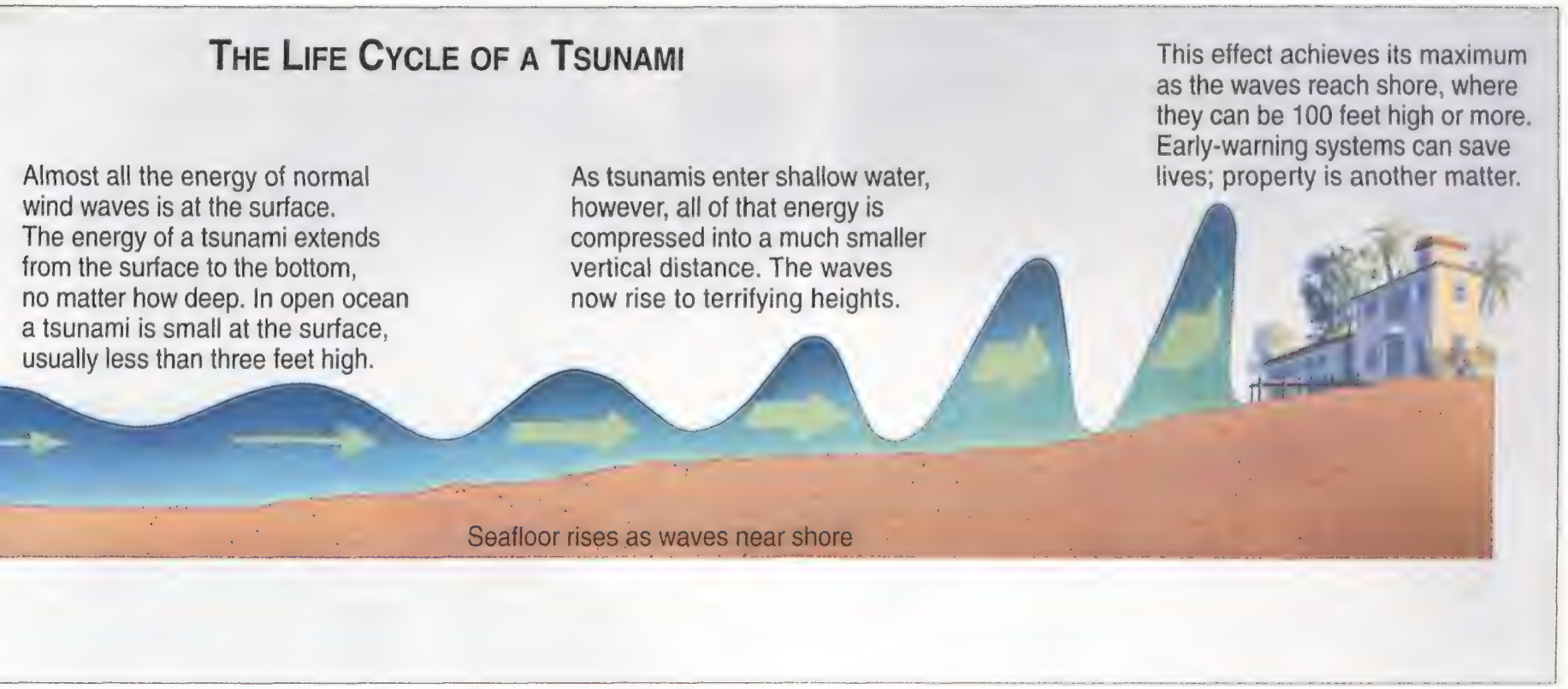
Of the more than 50,000 people killed by tsunamis in the past century, most probably had no idea they were in mortal danger. Occasionally, though, nature provides a warning. One is the violent, prolonged shaking of a major earthquake. If the epicenter is underwater or near shore, and if there is a vertical displacement of water, a tsunami can form. Another clue occurs when the tsunami's crest is preceded by its trough, and the water in bays and harbors suddenly rushes out to sea, leaving fish and boats stranded on the bottom. This ominous lull is a call to people who have experienced a tsunami to run for high ground. But curiosity will often drive the unwary to venture out and explore what lies exposed on the seafloor. Within 5 to 30 minutes the first wave comes thundering in at a speed that even the swift cannot outrun.

In 1946 an exceptionally powerful tsunami that formed off the Aleutian Islands of Alaska convinced the U.S. Government that it was time to set up a warning system in the Pacific. That tsunami was generated in the early morning hours of April 1, just offshore of Unimak Island, where two tectonic plates grind and gnash together as one slips beneath the other. Sometimes the two plates "stick," and a terrible tension builds up, eventually releasing its energy in the form of an earthquake. Such a release occurred on April 1. A magnitude 7.3 earthquake rattled the area for miles around, a section of seafloor shifted vertically, and a tsunami was born.

The five men stationed at the nearby Scotch Cap Lighthouse felt the quake but probably assumed they were secure inside their heavily reinforced, concrete structure, perched on a bluff 32 feet above sea level. But in the darkness 45 minutes later, a wave estimated to have been 100 feet high smashed into the lighthouse, disintegrating all but its foundation.

Five hours later, at about 7 A.M., the tsunami had traveled the 2,200 miles to Hawaii, and the first wave was about to broadside the islands. Wallace Young, who at 73 still runs the Ahmai clothing store in Hilo, was awakened by a phone call from a "Mr. Wong at the bank." Wong told him that a small wave had flooded the street in front of his shop, so Young hurried down to see if his building had sustained any damage. He was relieved to find everything intact at the store.

"Then I looked out the window and saw a policeman running up the street, shouting 'Here it comes!'" Young remembers. "I ran up to the second floor and looked out the window." A row of two-story, wood-frame buildings across the street blocked his view of the ocean. "Then I saw the buildings moving slowly across the street toward me. The only thing that stopped them was


THE LIFE CYCLE OF A TSUNAMI
Almost all the energy of normal wind waves is at the surface. The energy of a tsunami extends from the surface to the bottom, no matter how deep. In open ocean a tsunami is small at the surface, usually less than three feet high.
As tsunamis enter shallow water, however, all of that energy is compressed into a much smaller vertical distance. The waves now rise to terrifying heights.
This effect achieves its maximum as the waves reach shore, where they can be 100 feet high or more. Early-warning systems can save lives; property is another matter.
Seafloor rises as waves near shore

the sidewalk. A Hawaiian couple was hanging onto the ledge of a window. I'll never forget that." Throughout the islands 159 people were killed, including 96 in Hilo.

Hawaii is the bull's-eye of a target smack in the middle of the Pacific, vulnerable to Pacific-wide tsunamis that shoot north from Chile and south from Alaska. Of the 100 tsunamis that have struck Hawaii over the past century and a half, 16 have been destructive. In 1948 the Pacific Tsunami Warning Center (PTWC) was established just outside Honolulu.

The center has its fingers on the seismic pulse of a good part of the ocean's 64 million square miles, an area big enough to contain 21 countries the size of the continental United States. Though the PTWC was originally designed to protect Hawaii from tsunami attacks, its role has since expanded to provide coverage to more than 25 nations bordering the Pacific.

A couple of bicycles are usually parked outside the center's one-story building. Inside, a battery of 16 seismographs–their styluses nervously flitting back and forth on continuously rolling drums of paper–provides graphic displays of the Pacific's internal rumbles, heaves and groans. Three recorders chart information coming from tidal gauges. Quarters are cramped: the center's five scientists and three technicians compete for space with several computer workstations, a row of clanking teletypes and other electronic gear.

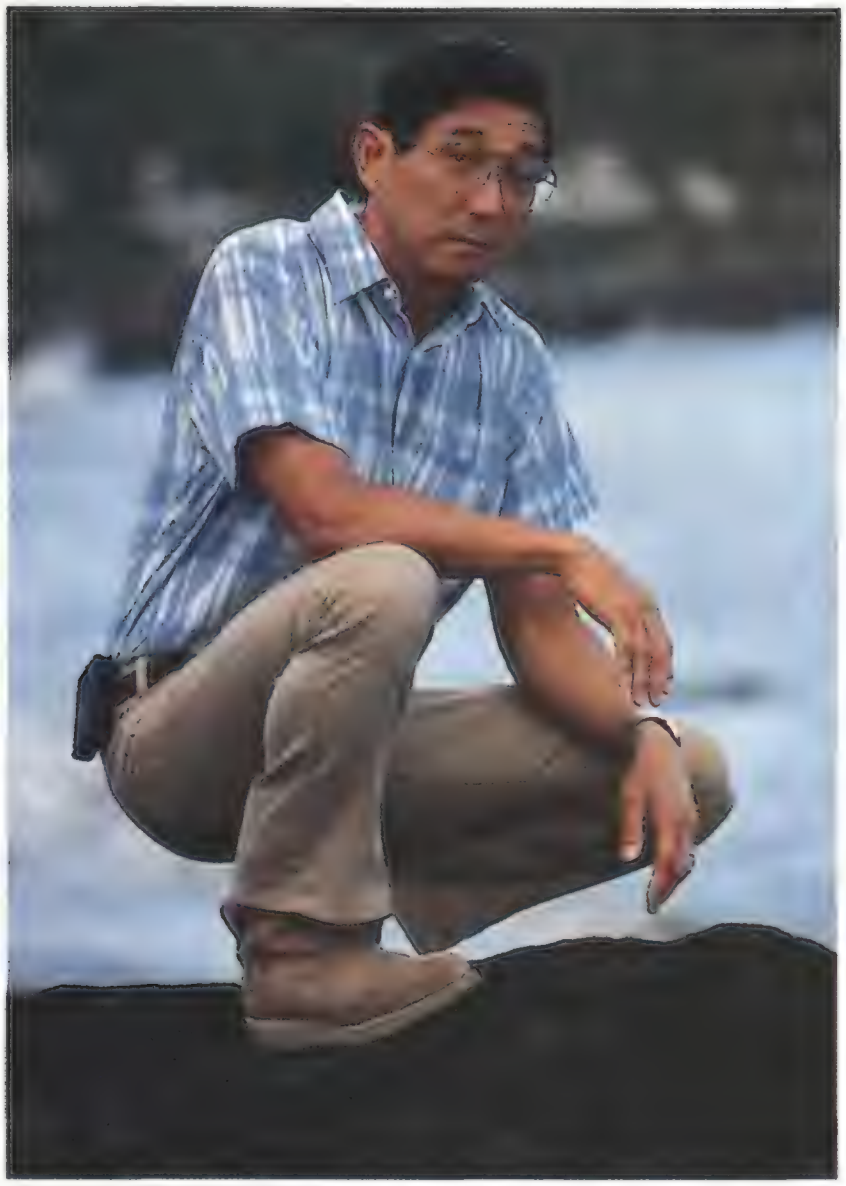
An odd, vague feeling of obsolescence pervades the place, as if time and technology had passed it by. In its first 16 years, the PTWC sounded warnings for two minor and two major tsunamis, saving perhaps hundreds of lives. But since 1960, when a giant tsunami from Chile swept away victims in Hawaii, Alaska, Japan and the Philippines, no catastrophic, Pacific-wide tsunamis have struck.

"We're like a fire station that has a fire every ten years," says Robert Cessaro, one of the staff seismologists. "We've got a hand pump and a fire truck from the 1950s. The truck's real old and it doesn't look too bad, but we're not sure it's always going to work."

Much of the PTWC's work involves collecting data about earthquakes and tsunamis from a worldwide network of seismic stations and from tide stations around the Pacific. They're building a comprehensive Pacific-wide historical record of tsunami activity that will help improve tsunami forecasting in the future. On most days the atmosphere at the center is placid, almost academic, as the scientists go about monitoring and servicing the machines, writing new software programs and checking communications lines to the outside world. But when the alarm sounds, the air crackles with urgency and purpose.

Alarms are automatically triggered when seismographs detect faulting powerful enough to launch a tsunami. Depending on where they originate, tsunami-generating earthquakes can range in magnitude from about 5.3 to 8.0 and above on the Richter scale. There's no way to predict when they'll happen. Sometimes an alarm goes off 20 times a month; other times several weeks will pass without one.

Bruce Turner, a 52-year-old geophysicist with an easy, affable manner, is one of the old hands at the PTWC. He says that after a spell during which the alarms have been silent, his sense of anticipation and foreboding grows keen. "I wake up thinking about them sometimes in the middle of the night," he says. "It's part of the job. We're



Harry Kim, civil defense director for the island of Hawaii, worries constantly about the next tsunami.

Flattened parking meters were left by the last major tsunami to hit Hilo, triggered by 1960 Chile quake.

tuned to listening for these pager alarms to go off. I've been in the house when the dryer alarm would go off telling me the clothes were dry, and without thinking, I just suddenly race for my keys and run out the door and get on the bicycle."

False alarms, sometimes triggered by interference in the phone lines that connect the center's recorders to remote seismographs, occur frequently. But once in a while an alarm is for real. When he first started at the center, Turner used to feel a surge of panic when the alarm would sound. Now he's more levelheaded when he hears the shrill electronic alarm–or his beeper.

The first step is to determine the general location of the earthquake. If it's local, then speed is critical. Island residents may have only a few minutes before a tsunami strikes. But if the earthquake has occurred in a far-flung corner of the Pacific, then the scientists can breathe a little easier, knowing that it may take several hours for a tsunami to reach populated areas.

Big local earthquakes are the ones that really snap the mind to attention at the PTWC. A scientist immediately gets on the hot line to Hawaii Civil Defense and informs them that the center is working on an earthquake and will have preliminary data for them in a few minutes. The other phones at the center are either ignored or put on hold because they are distracting. Then the scientists pinpoint the precise location of the earthquake by hand, using clear plexiglass scales to plot out the times that five different seismographs recorded signals from the earthquake. With this data and a graphic chart of the islands, they figure out which seismograph station received the signals first. This tells them which part of Hawaii is in the greatest danger. Another set of calculations determines the magnitude of the earthquake. If it exceeds 6.8 on the Richter scale, a tsunami may be on the way.

By now perhaps three or four minutes have elapsed, and the scientists keep an eye on the chart recorders that show sea level changes. If a tsunami has been created, it will appear as an abnormal blip on the recorder. That's when someone jumps back on the hot line to Hawaii Civil Defense, which then alerts residents of the impending danger with emergency radio and television broadcasts and sirens mounted on towers above populated beaches. The last time this alert went out was in

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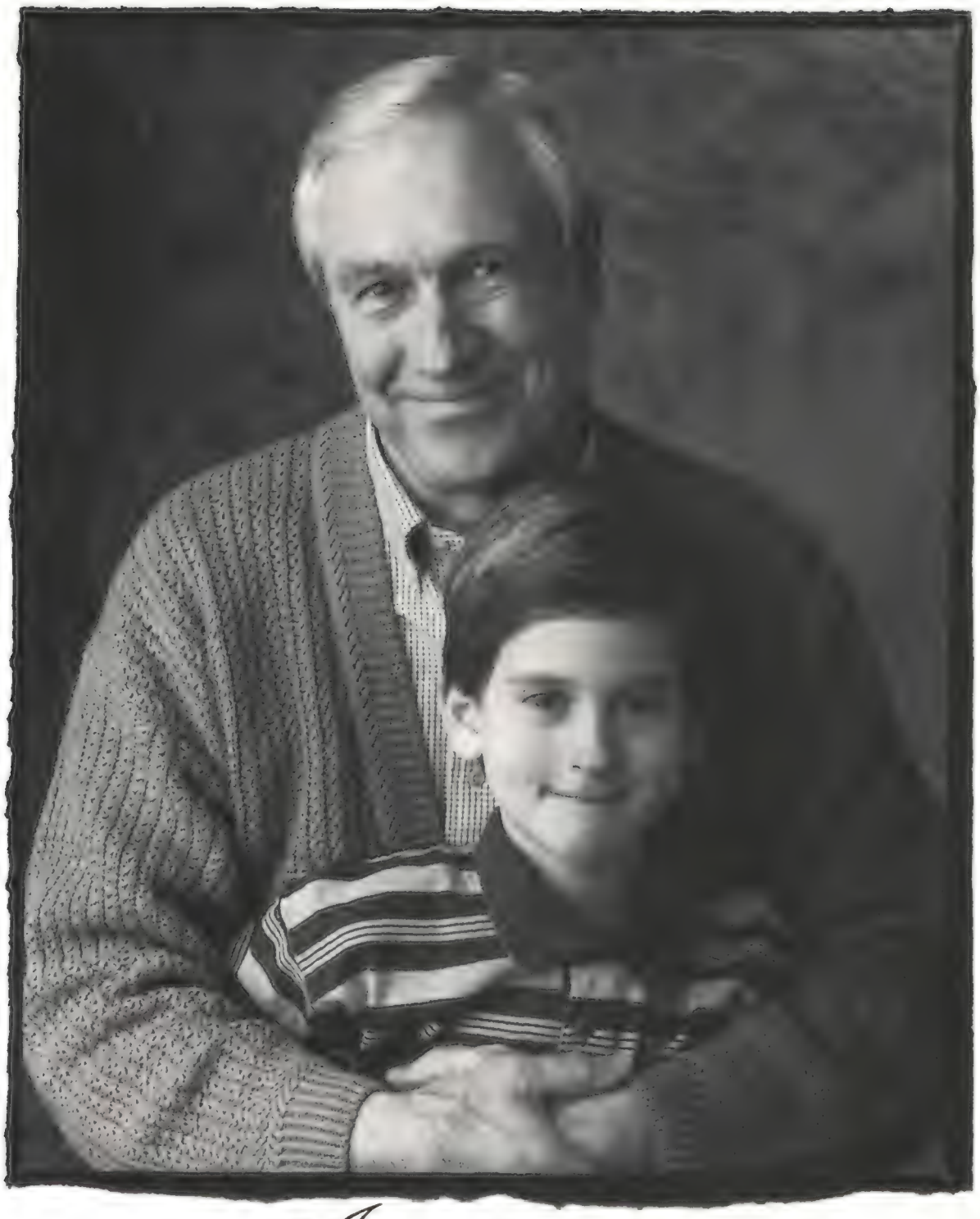

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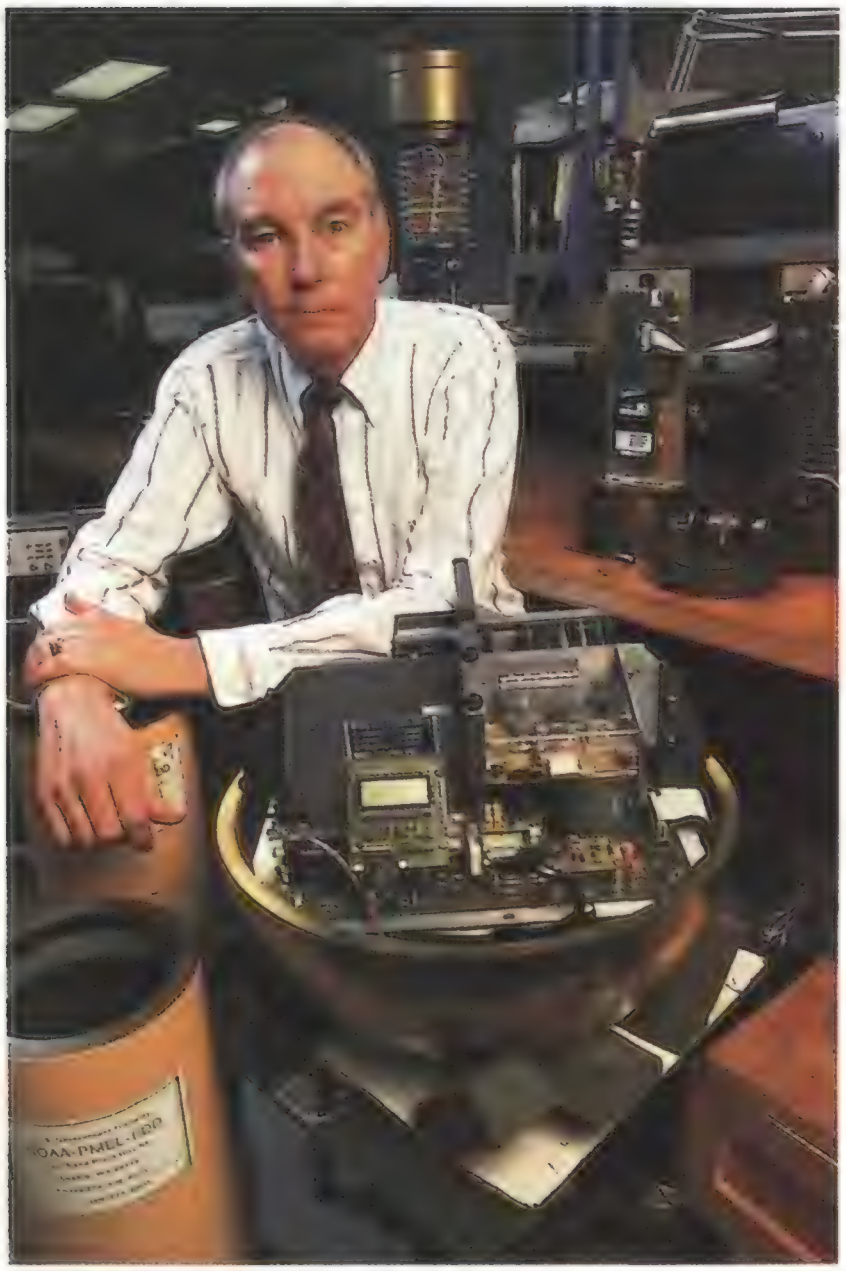
1975, when a local tsunami killed two campers on a beach on the southern part of the Big Island, a spot so remote that no warning could be given.

For an alarm triggered by an earthquake that occurs thousands of miles from Hawaii, the scenario at the PTWC is roughly the same but less frenetic. The staff determines the location and magnitude of the quake first. Although the location can be calculated in as little as 15 minutes, figuring the magnitude may take as long as one hour. And confirmation of an actual tsunami may not happen for up to two hours, when the water builds up over a shallow bottom, causing an abnormal reading to come from a tide station somewhere in the Pacific. A computer assists in predicting wave arrival times, and even though a tsunami may take as much as 14 hours to travel to Hawaii from its place of birth, the center is rarely off by more than 15 minutes.

Historically, about 99 percent of fatalities occur within 30 minutes of a tsunami's birth, on beaches within 250 miles of the point of origin. To protect people who live near active seismic zones, regional warning centers have been established that can sound alarms within 10 minutes. Hawaii, Alaska and the West Coast of the continental United States have such regional centers, as do Japan, Russia, French Polynesia and Chile. While these cover about 20 percent of the geographic area of the Pacific, only about 1 percent of the region's population is protected. Sophisticated warning systems are too expensive, and tsunami occurrences too infrequent, to persuade heavily populated countries such as Indonesia and the Philippines to build regional warning centers.



Eddie Bernard, a federal tsunami expert, designed a low-cost warning device for developing countries.

Some American scientists are working on cheaper warning devices. One is Eddie Bernard, director of the National Oceanographic and Atmospheric Administration's Pacific Marine Environmental Laboratory in Seattle. In the mid-1980s he led a group that developed a relatively low-cost warning system called THRUST. It uses simple, off-the-shelf components to measure earthquakes, relay data by satellite and issue warnings in as little time as 17 seconds. But there have been few takers so far.

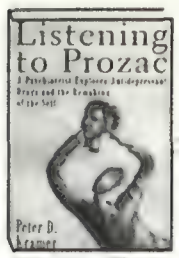
No warning system can help for one rare type of tsunami, that caused by landslides. Earthquakes are often the instigators of slides of mud, rock or ice that plummet suddenly into a body of water from above or slump down a submarine canyon. The impact can form enormous tsunamis. In 1958 the largest wave in history was generated this way in Alaska's Lituya Bay.

The seven-mile-long bay is located in southeast Alaska, 125 miles west of Juneau. On the evening of July 9, Bill and Vivian Swanson eased their 40-foot commercial troller, the *Badger*, into Lituya's narrow, sometimes treacherous opening to the sea and anchored just inside the entrance behind mile-long La Chausse Spit, which guards the bay from ocean swells.

The splash of "2,000 battleships"

At 10:15 P.M. the Swansons felt their boat shuddering violently and realized an earthquake was under way. In the fading light of the long summer dusk, they looked east toward the head of the bay, where three tidewater glaciers terminate and mountains of the Fairweather Range rise some 6,000 feet straight out of the water. Moments later, an estimated 390 million cubic yards of rock avalanched down from the 3,000-foot level, plunging into the bay within seconds. One observer later calculated the effect as "roughly equivalent to the simultaneous launching of 2,000 battleships from a slipway half a mile high."

The initial splash roared up the opposing hillside to an elevation of 1,720 feet, almost 500 feet higher than the 102-story Empire State Building. Every tree was severed or uprooted from the ground, neatly limbed and debarked. Soil was excavated down to bedrock. Then the wave, a tsunami 170 feet high, began heading for



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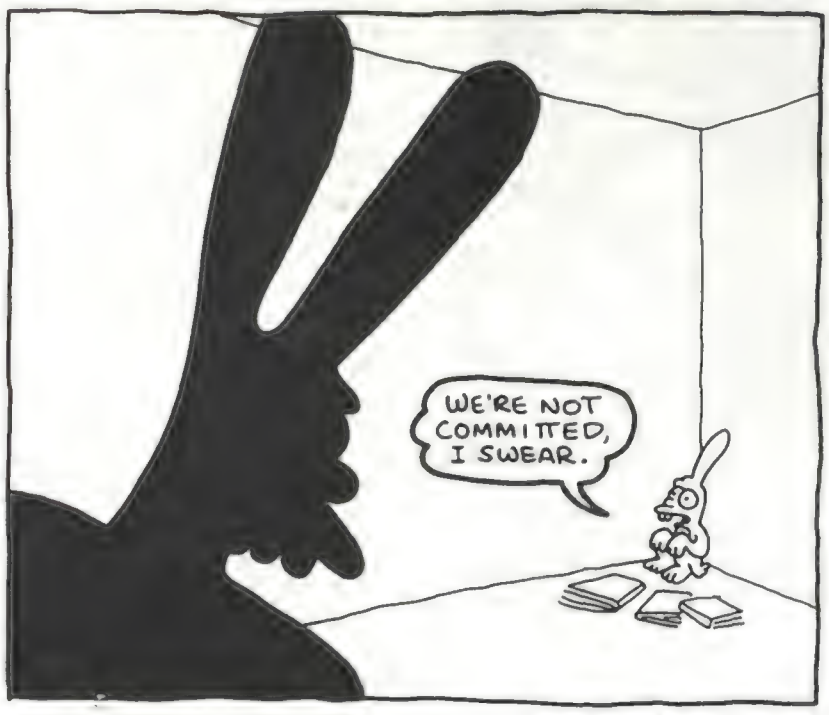

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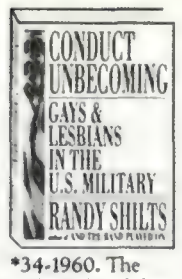

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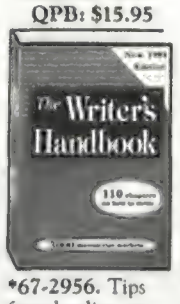

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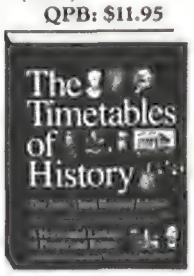

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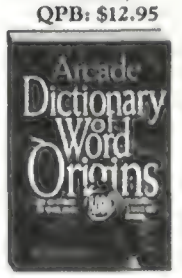

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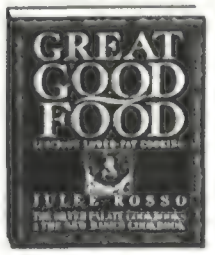

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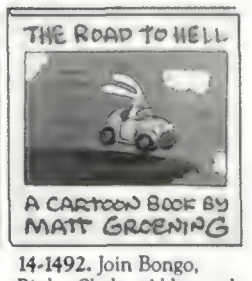

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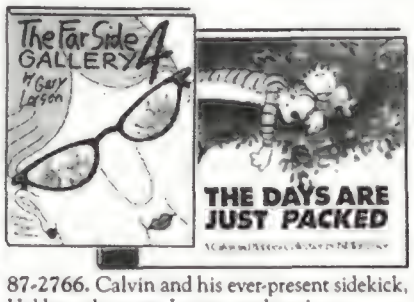

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At warning center near Honolulu, Bruce Turner checks seismographs that register quakes throughout Pacific.

the Swansons at more than 100 miles per hour. In the four minutes it took the wave to reach them, the Swansons could only watch in terror and astonishment as the wall of water, arcing across the two-mile width of the bay, rolled ever closer. For up to a mile inland from the shoreline, the wave was mowing down every tree as effortlessly as a combine cutting wheat.

When the tsunami finally reached the *Badger*, the boat shot upward to the wave's crest, snapping its anchor chain, and began to surf backward toward La Chausse Spit. Clinging to the railing, Bill chanced to look down and see the tops of trees he estimates were 80 feet below as the wave swept them over the 150-yard-wide spit.

Moments later, the tsunami flung the *Badger* stern-first into deep water. Her bow pointing upward, air trapped inside her hull, the troller refused to sink right away, giving the Swansons time to scramble into a skiff, from which they were picked up two hours later.

Distinct contours in the forests surrounding the bay provide evidence that four similar tsunamis have occurred in the 20th century alone, and it's easy to see why legends of their origins were created by the Tlingit Indians who once lived on the shores. The myths spoke of a spirit living beneath the bay who, when angered, would send forth waves to punish the people.

In other parts of the world, too, tsunamis may have had a hand in myth building. Along parts of the Mediterranean shoreline, scientists have discovered an ancient flood contour 300 vertical feet above sea level. It even extends more than 200 miles up the Nile Valley. The cause is still uncertain, but one hypothesis is that a great tsunami was responsible, one larger and more devastating than any since. The source of this tsunami was most likely the Greek island of Santorini, now called Thera. Around 1500 B.C., part of this volcanic island–an estimated 13 cubic miles of it–exploded. The energy released was calculated to have been ten times greater than that of Krakatau. The explosion birthed a tsunami of gargantuan power that drowned surrounding islands and the mainland.

Some authorities believe this tsunami, along with volcanic ashfall from Santorini's eruption, destroyed the Minoan civilization, centered on nearby Crete, which vanishes from historical records at about this time. There is also speculation that Santorini's sudden collapse gave rise to the legend of the lost city of Atlantis. Still others surmise that the flood myths of several Mediterranean cultures–Egyptian, Babylonian, Greek and Hebrew among them–were prompted by the Santorini tsunami.

Some have even argued that this great tsunami may have spawned the story of Moses parting the Red Sea. The hypothesis goes this way: when Moses and the Israelites reached the sea, with the Egyptian army on their heels, the water suddenly drew back, exposing sea bottom, as can an approaching tsunami. The Israelites fled across the briefly exposed seafloor. When they were safe on the other side, the monstrous wave swept in and finished the pursuing Egyptians.

A handful of geologists have made a specialty of reconstructing ancient tsunami events. Jody Bourgeois, a University of Washington geologist, has gone further back in time. In 1988 she hypothesized that an unusual layer of gravel in an outcrop along the Gulf coast of Texas was deposited by what she calls a "mega-tsunami." Calculating the height of waves necessary to transport the gravel as 150 to 300 feet, she reasoned that the only known source of such giant waves was a tsunami. But not just any tsunami. She knew that an earthquake couldn't generate a tsunami that big. That left a collapsing volcano, like Santorini, a landslide such as the one at Lituya Bay–or something bigger.

The biggest wave of all?

Fossil-dating techniques had given the layer an age of 66 million years, hinting at another possibility. The gravel layer was deposited at the same time at which scientists think Earth was struck by asteroids, perhaps contributing to the extinction of dinosaurs. If an asteroid plunged into deep water, it may have done the world's splashiest cannonball, sending up a colossal wall of water Bourgeois said might have been 3,000 feet high at impact–enough to set up a sufficiently large tsunami.

If mega-tsunamis occur once every few thousand or few million years, and destructive tsunamis appear only once a decade, coastal dwellers can relax most of the time. The ones who do worry are those whose job it is to

protect people. One is Harry Kim, director of civil defense for the island of Hawaii.

In his Ford Bronco, Kim is patrolling the waterfront of Hilo, the largest city on the island. Hilo is struck by tsunamis more often than any place in the United States because of an unfortunate combination of location and offshore bottom topography that funnels tsunamis into the harbor. About 60 percent of tsunami fatalities in all of the Hawaiian islands have occurred in Hilo.

"You don't go to the ocean anymore and look out to sea and enjoy the day," Kim says wistfully about his work. "You look and sometimes your thoughts run away about a tsunami impact, and you ask yourself, Have I covered all the bases?"

In Kim's case, the answer is: probably. Because of the frequency of tsunamis in Hilo, civil defense in Hilo is serious business. At the first hint of trouble, Hawaii Civil Defense is authorized to cut directly into radio and television broadcasts to warn the public. Every telephone book has maps that show tsunami inundation zones and safe areas. Towers topped with sirens stand at most beaches. Road signs mark escape routes. "Our office controls all the agencies–military, police, the media, what have you," Kim says. "We have total control, a dictatorial, communistic type of control."

Kim says his department is ready for the next wave, which many people believe is overdue. The one thing that makes him uneasy is that the thousands of newcomers to the islands have no idea what a tsunami can do. Their lack of knowledge, Kim says, could be the "kiss of death." His words echo what PTWC geophysicist Bruce Turner said about the dangers of complacency: "A tsunami can happen anytime, next month, tomorrow. Since 1960 we have had one warning in 1986 and one small, local tsunami in 1975. There's a whole generation of people that have grown up without having seen anyone killed by a tsunami, without having to pull dead bodies out of the mesquite bushes around here, or seeing 80-foot boats that have gone through their living rooms. People tend to forget."

In Japan the main town on the island of Okushiri was devastated by a tsunami that struck last July 12. A 16-foot-high seawall had been built ten years earlier, but the wave was at least twice that height.

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Maybe small towns aren't fancy, but at least they're real

You can forget those slick Hollywood versions–photographer David Plowden celebrates small towns by presenting them as they really are

America has always been a nation on the move, an antsy republic of migrants and wanderers ever ready to pull up stakes at the closing of a factory, the failure of a crop cycle or the vague promise of a better life somewhere else. Among the casualties of our footloose ways are the countless small towns we have created in effusions of optimism and subsequently abandoned when time and hope ran out.

Today most of us live in cities and suburbs, but across the country thousands of rural communities still exist. Some are holding their own; many are not. Over the past several years, the noted photographer David Plowden has visited a number of these survivors, often arriving just a step or two ahead of the wrecker's ball. In his new book *Small Town America*, published by Harry N. Abrams, Inc., he compiles a vivid record of the things that make such places what they are.

Plowden portrays his towns with the bark on. He depicts streets and post offices, banks and churches, movie theaters and saloons without prettifying them. He poses people–businessmen and barbers, farmers and football coaches, judges and juveniles–the same way. As the pictures reproduced here make clear, he has a passion for authenticity–the Coca-Cola signs on a grimy storefront, the trophies adorning a parlor wall.

These unvarnished images are ambiguous. They remind us that many small towns are a far cry from the idealized versions we often see portrayed on television and in movies. They can be scruffy, lonely outposts. But although they may lack certain amenities that are taken for granted elsewhere, the places Plowden shows us have one thing many larger, newer, more affluent communities lack. They have character.

Jim Doherty

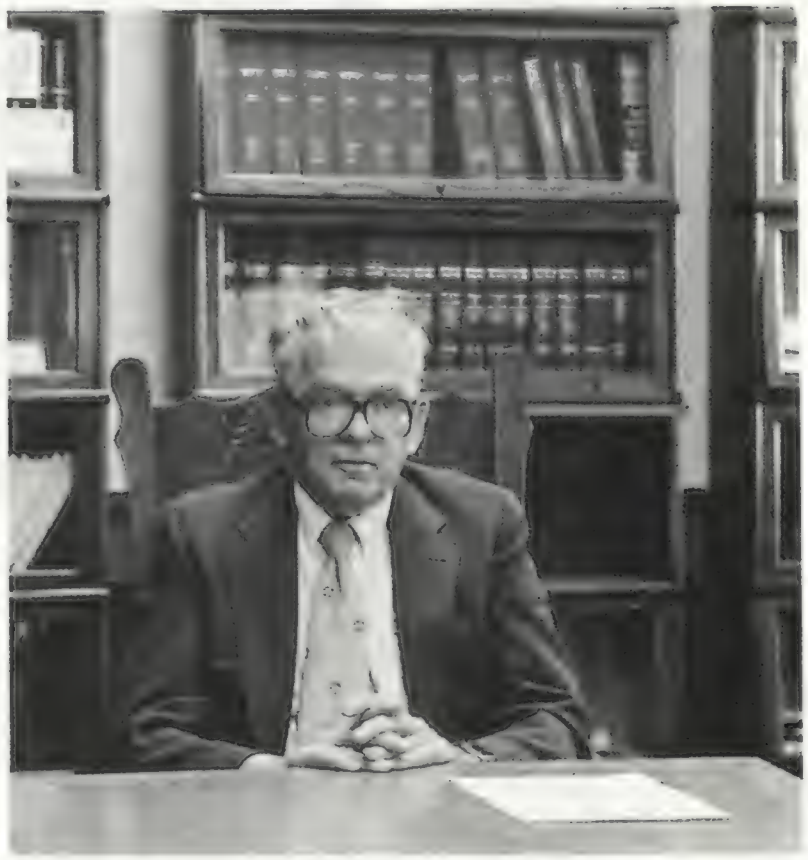
POST OFFICE AND GENERAL STORE, ELDRIDGE, NORTH DAKOTA

DRINK
Coca-Cola
GROCERIES
DRINK
Coca-Cola
ENJOY
Coca-Cola
ENJOY
Coca-Cola

Wesley Chapel, near Hastings, Iowa

Parlor, Springville, New York

Postmaster, Hastings, Iowa

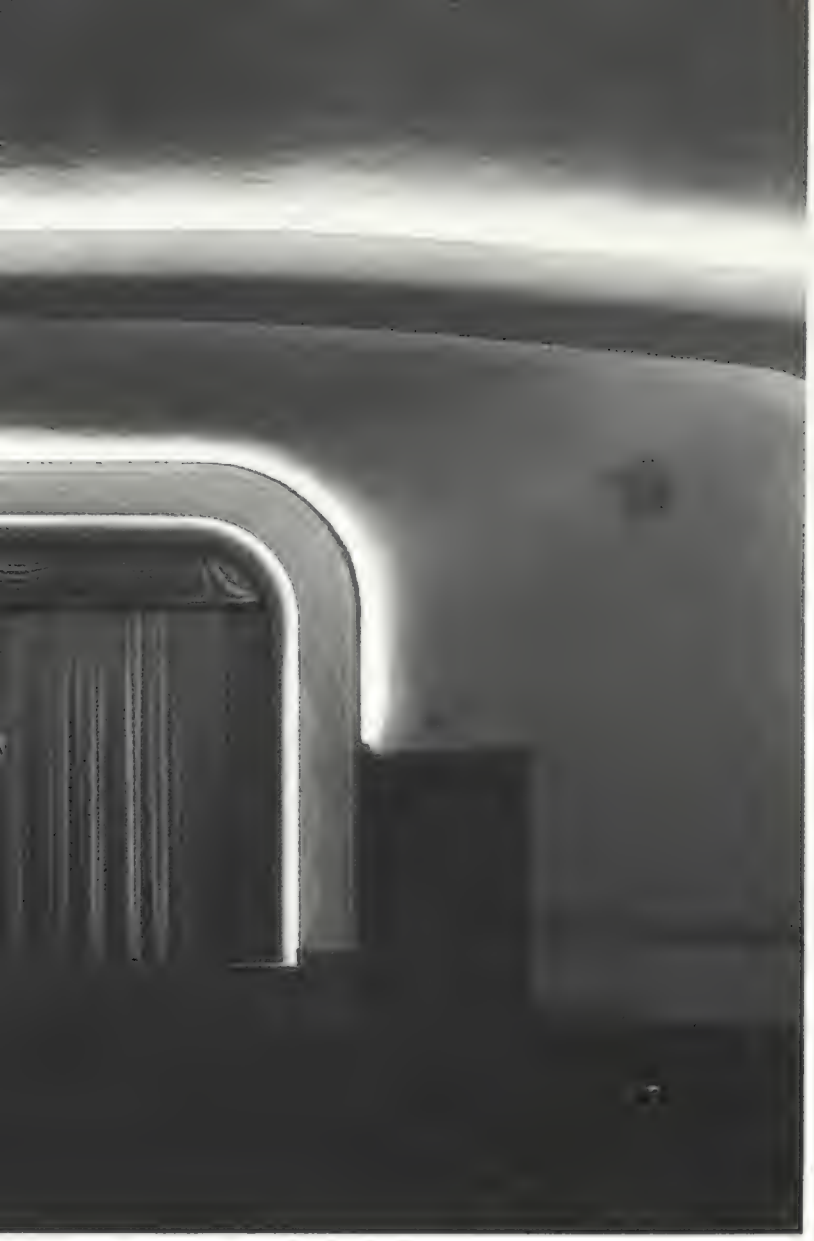


Judge, Waseca, Minnesota

Ophthalmology office, Waseca, Minnesota

Joylan Theater, Springville, New York

Clothing store, Victor, Iowa



Staircase, Brooklyn, Iowa

Office, Victor, Iowa

Girl on bike, Scotch Grove, Iowa

Assistant coach, South Haven, Michigan

Running back, South Haven, Michigan

The Western House, Springville, New York

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Buckle up, America!

By Richard Conniff

The mole has a way of undermining our assumptions

It's not a rodent, it's not stupid, it's not unaware of danger, and yes, there is method behind its seemingly haphazard tunneling

It was a cold, damp March morning in the Border Country of northern England. Snow lingered along the field walls, making white stripes across the green Northumberland hills. Lapwings and curlews tumbled overhead. Peter Rutherford, professional mole catcher, was advancing across enemy territory, a pasture pocky with hundreds of mole diggings. He surveyed the wreckage for activity, then whispered, "There may be one puttin' up a heap over there."

He crept forward in his muddy boots. With a loose stocking cap on his head and a shovel strapped across his back, he looked like a sapper in the army of King James reconnoitering some ancient fortification. He gestured with his hand to hold up. After a tense moment poised with shovel ready, Rutherford suddenly plunged forward to the attack.

The blade sliced into the earth on one side of the mole heap, and Rutherford sprang round and jammed his heel down to close off the tunnel on the other. In another instant, he had the heap and a six-foot line of suspected escape routes dug out, muttering, "Come on, son, where the hell are ye?" He dropped to his knees

Making a rare appearance aboveground, a common European mole prepares to burrow its way back into the security of a subsurface tunnel, using paddle-like appendages to scrape soil and push it rearward or up.

and ran his hand along the excavated banks, feeling for side tunnels.

"There he is!" he yelled, indicating some imperceptible quaking in the soil. And then, ferociously, "Yer knackered!" His hand pursued the unseen mole into the earth. "Where the bloody hell are ye now?" he demanded. "Ye bastard." He was up to his elbow in the dirt. His face went red with vexation and doubt.

Then, triumphantly, Rutherford pulled his hand from under the bank. In his grip was a squirming mole, a female six inches long, her pink paddle-feet scrabbling against the unfamiliar air. Her mouth gaped in outrage, exposing a long, narrow jawline of needle-wicked teeth. She shrieked like a crow, a sound alarmingly at odds with the meek and genteel image of Mole, the celebrated character in Kenneth Grahame's children's classic *The Wind in the Willows.* "She's a bit upset," Rutherford said, as if apologizing for an old acquaintance. Then he turned on her venomously, "Ye little sod, ye!"

A little subterranean wrecker of lawns and pastures–that's the mole's reputation and the source of Rutherford's livelihood. With its spongy tunnels and its ability to ravage a fairway or front yard with two-foot-high heaps of dirt, the mole has a knack, as a British writer recently put it, for driving mild country parsons to prime their shotguns and bank managers to grin malevolently over their harpoon traps. The mole has burrowed not just into our yards but under our skin, and become an object of murderous indignation.

People set traps designed to kill a mole by exploding a .32 blank cartridge in its face, by spearing it or by strangling it in a scissors grip. They put broken glass, razor blades, thorns, mothballs and exhaust fumes down mole tunnels. They invest in sonic repelling devices, which use precisely the high-frequency sound waves that die out most rapidly in dirt, evoking indifference, if not scorn, among the moles.

A molehill brings down a king

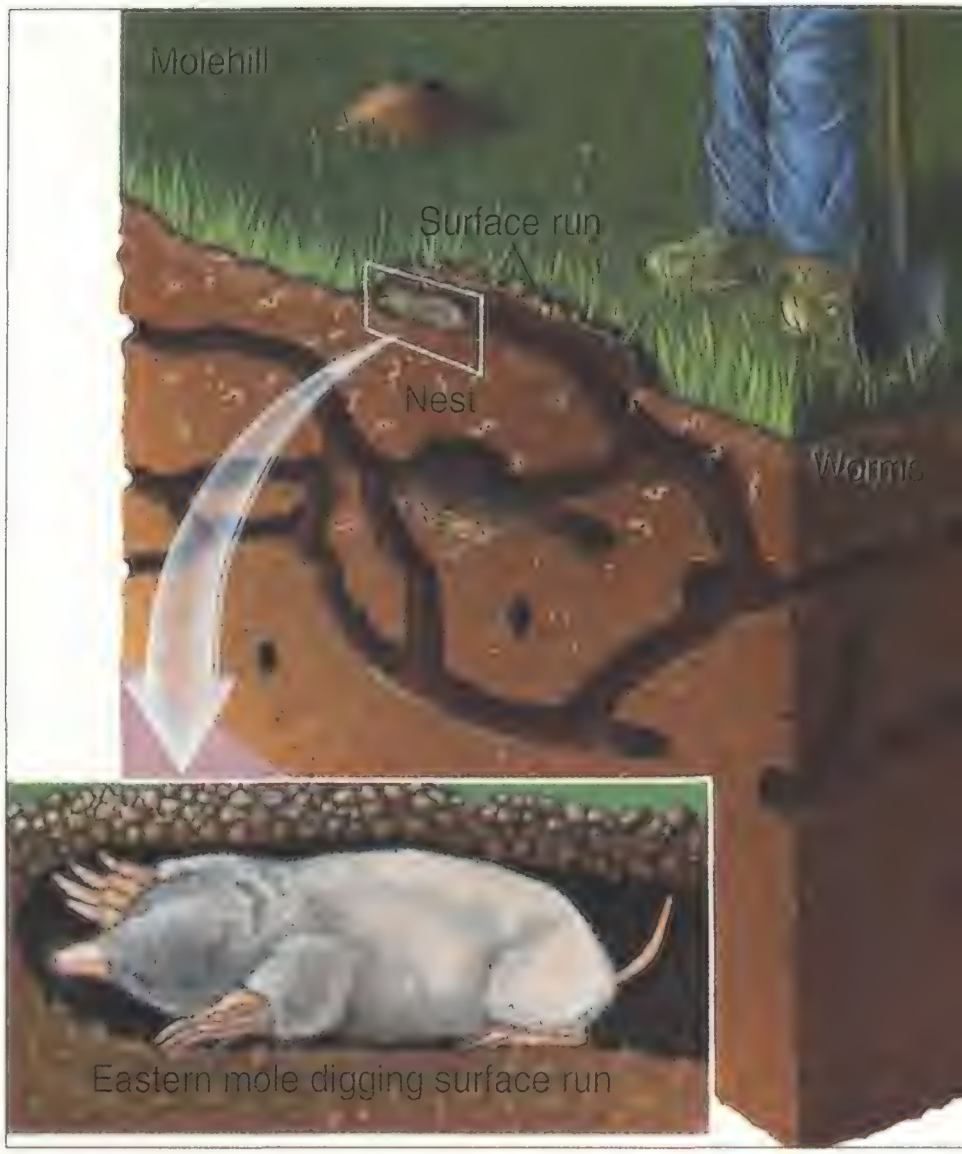
Outside of children's literature, you have to look a long way to find a kind word about moles–and even when you find one, it has to do with destruction. Certain Scots still fondly recall that King William of Orange, cruel usurper of their own King James II, died from a fall when his horse stumbled on a molehill. They sometimes drink a toast to the "little gentleman in the black velvet waistcoat."

Otherwise, human attitudes toward moles constitute a lengthy chronicle of contempt. The creatures customarily have been regarded as disgruntled loners and "raging psychopaths of the countryside," according to mammalogist Martyn Gorman, inclined to fling themselves furiously at any living thing unlucky enough to cross their trail, including other moles. The mole has

Mole catcher Peter Rutherford lunges toward a tunnel with spade, hoping to trap animal before it escapes.

plenty of reason to be angry, common wisdom tells us, because fate has trapped it in an endless, insatiable round of digging and eating. Its only blessing is that it is blind. That way, it can't see what a lousy life it leads, "ever destined to live in darkness," as Oliver Goldsmith put it, entombed from birth to death in its grave.

Out of the ground, the mole might well *look* contemptible. Depending on the species, its eyes are either completely hidden or barely visible and perceive little more than changes in light level. Its pink, uplifted nose and its meandering side-to-side movements bespeak shortsighted uncertainty. The way the head widens without any visible neck into the relatively massive upper body musculature suggests not just a strong back but its corollary, a weak mind. Children's books depict the mole as a kind of absentminded professor. In truth, it looks more like a no-neck nose tackle who's lost his contact lenses at the line of scrimmage but is nonetheless hellbent on doing damage. On appearances alone, it is entirely understandable that a wretched landowner would see ample cause to belittle the creature that is ac-



When a homeowner sees a mole tunnel, there may be a network of other tunnels below, as illustration shows.

tually driving him insane. One morning in Northumberland, Rutherford pointed out 143 dead moles hung up by a farmer in a grim row along a strand of barbed wire, as if to say, "Take that, you bloody little rodent!"

But moles have a way of confounding our assumptions. For one thing, they aren't rodents at all, but insectivores, like shrews and hedgehogs. The moles are a small group; there are only about 30 species in the world. North America has 7 species, from the Townsend's mole, which bedevils dairy farmers in Oregon's Tillamook cheese country, to the star-nosed mole in the Northeast, which looks as if it's got a sea anemone stuck on its snout (p. 56).

The moles are a venerable lineage. The fossil record of their recognizable ancestors dates back about 45 million years–far earlier than our own direct forebears–and moles appear to have made good evolutionary use of their head start. Researchers have begun to demonstrate that, far from being the literal wretched of the earth, moles may–astonishing!–be perfectly adapted to live precisely the way they live. Gorman, of the University of Aberdeen in Scotland, argues that moles actually lead "rather charmed lives" underground. He studies the common European mole, the archetype for moles in children's books, scientific research and the historical fur trade.

Most of the mole's obvious adaptations serve to make it a better digger. Other burrowing mammals dig with their forepaws underneath them, in doggy-paddle fashion. But the mole's pectoral girdle benefits from a dramatic rethinking. The humerus, equivalent to our upper arm bone, angles up and out from the body; it's also flat and wide, the better for attaching large digging muscles. This setup causes the mole's forelimbs to stick out to the sides like gates, and it maximizes the power of the sweeping stroke the mole uses to scrape soil from the sides of its tunnel and push it rearward or up to the surface. Some moles also have an extra bone in each paw for a broader shoveling surface.

This equipment makes moles prodigious diggers and is the source of their cartoon reputation for churning across lawns before some outraged human's eyes. A mole can dig 60 feet or more of subsurface tunnel in a day–roughly equivalent to a five-foot-tall woman burrowing the length of two football fields. (To compete with the mole, by the way, the woman would also have to be able to move objects in her path, up to, say, 4,000 pounds. One thinks of Carla, the waitress in *Cheers*.)

The mole has evolved the means to manage its workload while breathing rank, carbon dioxide-laden tunnel air, the equivalent of what humans exhale. A fifth of its body weight is given over to its voluminous lungs. Its blood is also adapted to its way of life, almost visibly. When a mole like the one Peter Rutherford plucked from the ground meets its usual demise–by a sharp rap on the head–gouts of blood as bright and saturated as

Richard Conniff reports that moles have turned his own lawn into sponge cake. He has written most recently for SMITHSONIAN *about sharks and worms.*

Elaborate system, which may contain more than one nest, provides plenty of earthworms for mole to eat.

Grisly x-ray shows how a mole "dug" its way out of a gull after it was swallowed alive. Both creatures died.

enamel drip from its earholes. Moles contain twice as much blood as other mammals their size and twice the amount of oxygen-bearing hemoglobin.

So far this might not seem to rival Paris in the 1920s in the category of charmed lives. Indeed, in their book *The Natural History of Moles*, Martyn Gorman and coauthor R. David Stone give a subchapter the plaintive title "Can Moles Do Anything Else But Dig?" The answer is yes, they can sleep, and they spend half the day at it. To confirm this, Gorman and his associates radio-tracked moles for the first time, using Superglue to attach microtransmitters to their subjects' rumps.

For two weeks, one of Gorman's students, Sara Frears, tiptoed around a field in Northumberland once every hour, recording where each radio-tagged mole was located underfoot and what it seemed to be doing. In between, Frears holed up from the January west wind in her unheated van, thinking enviously about the underground way of life Mole describes so fondly in *The Wind in the Willows*: "Nothing can happen to you, and nothing can get at you. You're entirely your own master . . . . Things go on all the same overhead and you let 'em. . . ." Frears notes that the temperature is relatively constant underground, and that her snug little moles did not need to grow a thicker fur coat, lay on fat, alter their metabolic rate or make any of the other customary physiologic concessions to winter.

Frears was interested in how moles use energy, and her calculations suggest that even digging isn't as hard for a mole as it's cracked up to be. A mole burns only about five times as much energy digging as when it's resting. By contrast, a bat's metabolic rate spikes up by 10 to 30 times when it flies. Moreover, while flying is the basic means of gathering food for a bat, digging isn't for a mole. Moles spend only about two and a half hours a day digging in the peak tunneling season of winter and only a few minutes a day in summer.

And yet the mole is a voracious eater. It consumes about half its weight daily, and it can take 15 or 20 juicy nightcrawlers to knock the edge off a day's appetite. (Frears once kept ten moles in a lab and found that digging up enough worms to feed them was a full-time job. An American researcher complains that his three moles ran through $17 worth of worms in just two days.) So where does its food normally come from?

The genius of the tunnel system is that it brings the

Aptly named star-nosed mole emerges from the soil snoutfirst. Tentacle-like rays may help seek out prey.

Two star-nosed moles fight after bumping into each other while reconnoitering aboveground in central Maine.

prey to the predator. Worms literally drop in, as an English countrywoman puts it, "like bacon and eggs on the ceiling." Because worms and insects are constantly passing through, all the mole has to do for a meal is amble periodically around its estate gathering up the latest crop of houseguests.

This larder is so reliable that the mole carries around only about 2 percent of body weight in fat, enough to keep itself alive for less than a day. "There's a cost to carrying around body fat," says Frears, especially when the animal has to squeeze its bulk through a tunnel of its own making. "And why pay the cost if food is readily and reliably available?"

Each mole patrols its own estate in solitude. These estates may overlap in places, but the moles live up to their reputation as loners. They've evolved a time-sharing strategy to avoid the horrid prospect of actually meeting up with a neighbor.

Moles make their rounds three times a day, with each activity period lasting three or four hours. They are acutely aware of their neighbors' movements, and all the moles in an area leave and return to their nests at about the same time, like workers in a company town. But the moles appear to use their overlapping tunnels only once a day, discreetly avoiding these areas when another mole is present.

Early accounts of the mole's ferocity relied largely on reports that two moles placed in the same box often fought to the death. But in their own world, moles are more subtle. They communicate their presence and avoid brutal confrontations by scent-marking on their daily rounds. Because the worms in their diet are largely water, moles urinate abundantly, which may make it easier for them to mark several hundred yards of tunnel a day.

When a body meets a body...

"Chasing season" is the one exception to their fierce isolationism, when a switch suddenly flips somewhere in the male and he goes burrowing off in a beeline until he breaks into the tunnel system of "an attractive and welcoming female." The phrase comes from Gorman and Stone, who perhaps should know better. The female is generally hostile. Indeed, Gorman and Stone speculate elsewhere that her ovaries may actually produce male hormones for much of the year. This might explain not just her aggressiveness but her external resemblance to the male. Except during the mating season, the vagina is sealed shut, and the urinary projection closely resembles the penis of the male, who also lacks a scrotum. Mating appears to be brief, violent and confused. Peter Rutherford reports that you can hear the caterwauling rising up from underground, and it doesn't sound like splendor in the grass.

The female wastes little time on mating or family life,

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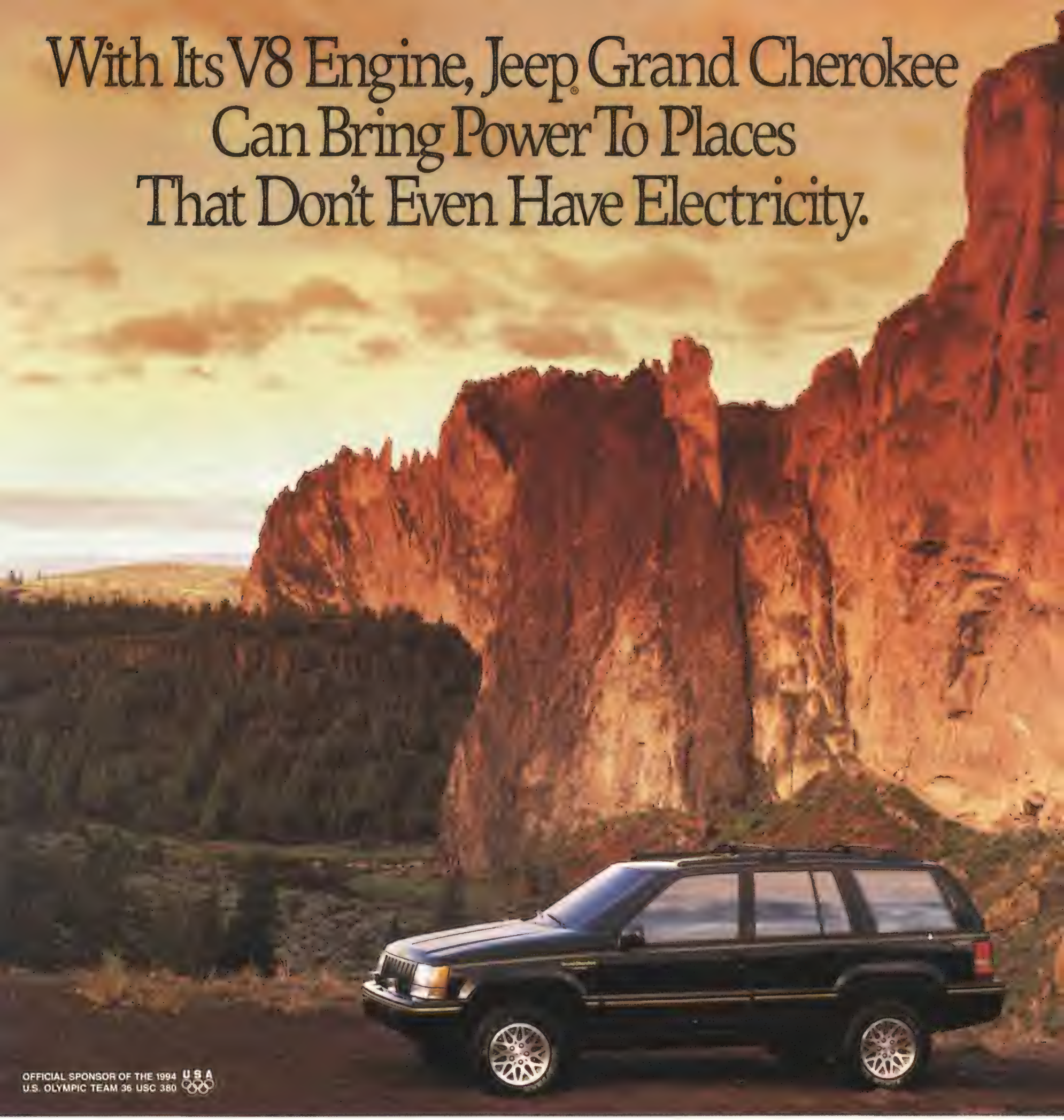

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A good hunter despite poor vision, star-nosed mole snatches an earthworm underwater. Earthworms emit an electrical field the mole's elaborate proboscis evidently can detect. Moles frequently prey on worms.

but the latter is at least quality time: her milk boosts the three or four youngsters in her annual litter to 17 times their birth weight in three weeks. Then they get the heave-ho, and everyone goes off to the chief business of moley life, which is gathering worms in blissful subterranean solitude.

When a mole finds a worm, it generally pins the body between its forepaws while pulling up on the head with its teeth. Squeezing the worm in this fashion, like a tube of toothpaste, may help clean soil off the surface. The mole gobbles the meal with an eager, almost ecstatic quivering of its whole body but doesn't necessarily bolt down everything it meets.

Sometimes a mole merely nips off a worm's first two or three segments. Then it balls up the remainder and rolls it back to the nest, to be stored for future use. Out in the Northumberland hills one morning, Peter Rutherford discovered a nest mound, a pile of dirt slightly larger than the waste heaps moles had put up all over the field. He opened it with his shovel and quickly turned out the mole's bed of dry grass. A network of tunnels ran through the mound, and Rutherford speculated that some of them were designed for drainage, to divert water away from the nest.

Along the gallery tunnels of the mound, Rutherford started to unearth stored worms. Each one was coiled in a loose knot and tucked into its own honeycomb pocket, immobilized but still alive. "When you take one out, it'll dig itself into the ground again," he said. "So you wonder, why don't they just nick off? See how they're pushed into little round pockets? I think the mole must seal them in with clay balls to stop them." He plucked up the coiled worms and tossed them in a pile on the grass. For a mole catcher, as for a mole researcher, gathering worms is half the job. Rutherford would stir this lot of worms with poison and redistribute them in mole tunnel systems all around the farm. "I've struck it rich," he said, still digging. "There's bloody hundreds."

The coiled worms were like the living dead, slightly diminished in bulk and paler than usual–some of them almost opalescent. "Even though they have their noses cut off, they keep on shiting," said Rutherford. "And they shite all the muck out of them." He gathered up the cold, wriggling mess of worms in his cupped hands, 133 in all. Other investigators have found up to 1,280 worms, weighing more than four pounds altogether, cached in a single nest.

Having mixed the worms with poison, Rutherford headed into a new pasture, remarking, "Look at the bloody moldies in here!" He surveyed the blackened heaps, deciphering which territories were active and which tunnels were major routes. Then he plunged a wooden stick into the ground, finding the hollow of a tunnel as deftly as a phlebotomist seeking a vein. With a twig, he lifted a worm from his bucket and dropped it into the tunnel. Then, because moles are sensitive to any intrusion, he closed the hole with his heel. "The next time he comes along, he'll get a bellyache."

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Hairy-tailed mole is found only in North America. Like eastern mole, it, too, is blamed for "ruining" lawns.

Its bumbling image to the contrary, the mole is extraordinarily alert, in its own world, to the faintest hint of trouble. The poison was strychnine, which can be perilous even when applied underground; dying moles are sometimes found and eaten by other predators. But strychnine is the only poison now known that fools the mole's keen sense of smell. A mole will also "push a trap right out of the ground," said Rutherford, if it detects human smell.

The sense of vibration may be even more acute. The mole cruises its tunnels with its tail touching the ceiling, like the overhead pickup on a trolley car. The tail, head and feet are lined with sensory vibrissae–rigid hairs set in fluid-filled sacs to amplify the slightest mechanical stimulus. Even when it's digging so furiously that you can hear the sound of roots tearing, the mole seems to sense approaching danger.

The Rutherford family once had a spaniel that could creep up and point on a mole working underground. But when a plodding human came close, the mole would rush to the cover of a deep tunnel. Rutherford recalls the dog looking back witheringly at its clumsy master, as if to say, "Ye idiot." Few predators get close enough to kill a mole, one of the central charms of underground life. Those that do may wish they hadn't. Gorman has an x-ray of a herring gull that ate a mole. The mole proceeded to dig a hole in the gull's stomach, shoulder its way through the wishbone and get its head halfway out the gull's neck before both animals expired.

Fixated as we are on the sense of vision, humans can scarcely imagine the world as the mole perceives it. The mole's snout is covered with a cobbled, fleshy structure that contains highly sensitive receptors called eimer organs. A researcher enthuses that the eimer organ is "unexcelled in complexity in the whole animal kingdom," then adds that no one knows for sure what it does. In one experiment, a molelike desman could distinguish a full food container from an empty one by using its eimer organs to "read" lines that were engraved, like incredibly minute braille, on the lids. Another researcher speculates that the mole may use its eimer organs to detect thermal emissions from worms, which are slightly warmer than the soil around them.

Few animals make better use of their snouts than the star-nosed mole. This bizarre North American species split off from its fellow moles about 30 million years ago, according to Terry Yates, who studies mole evolution at the University of New Mexico. Star-nosed moles can dig like other moles, but to exploit their marshy habitat, they've also evolved in a way that enables them to pursue their prey underwater. Yates writes that they swim even under the ice on frozen lakes and streams. The star-nosed mole's tail is long and rat-like, unlike any other mole's, and in the water it apparently functions as both rudder and paddle. Also unlike other species, the star-nosed mole lays on fat seasonally, perhaps because it ventures out into cold weather so often. The tail can double or even triple in thickness as the seasons change; it's an ingenious place for a burrowing animal to carry extra fat while still remaining streamlined for tunnel travel.

A snout even Cyrano would envy

But it's the nose, not the tail, that gives this species its name. No snout in the mammal kingdom, not even the elephant's trunk, is as mobile and complex. Around this mole's nostrils, 22 tentacle-like rays fan out, wriggling continuously as if to taste the air, water or soil the animal is traveling through. Researchers have theorized that these rays serve primarily as touch receptors.

But Edwin Gould at the Smithsonian's National Zoological Park recently demonstrated that the nose may also be a remarkably specialized electrosensory organ for finding prey in muddy water. Worms emit an electrical field, and when Gould simulated this field with a buried penlight battery, the moles seemed to home in on the signal. He also observed that when a star-nosed mole swims, it swings its head from side to side. On picking up an electrical signal from a worm in the water, it lunges across the final inch or two. The bite typically lands on one of the electrical hot spots on the victim's body. This may be a serious blow for the image of the mole as a bumbling, faintly pathetic animal.

But the image, unlike the worm, will probably survive. Moles being largely unseen in real life, most people will continue to get to know them mainly from *The Wind in the Willows*. Since its publication in 1908, this tale of

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In illustration from *The Wind in the Willows*, stalwart Mole leads horse while friend Toad trudges behind wagon.

Mole and Toad rambling across the English countryside (above) has endeared moles to millions of readers. It hasn't spared them from persecution. But the mole nowadays typically gets affection along with annihilation. This is true even at the vast country estate in Henley-on-Thames that Kenneth Grahame used as his model for Toad Hall, the main setting for his story. "Luckily, they've most of them just been trapped," the lady of the house told a recent visitor, and then she felt obliged to add, "They really are adorable-looking things. I wouldn't want them to become extinct. It's just that there are so many."

Indeed, there are so many that, improbable as it may sound to delicate modern sensibilities, moles once supported an entire industry. From the late 19th century until about World War II, moleskins and furs were an article of high fashion, in part because of the mole's special adaptations to underground life. The hair moves readily in any direction, enabling the mole to advance or retreat with equal ease through a narrow passage. Furriers once used the soft four-inch-square skins to make moneybags and muffs, to trim coats and to stitch together into whole garments.

King Edward VII started a rage for moleskin vests in 1903. It took 75 skins to make such a vest, according to one account, and it was customary for it to be joined together in front not with buttons but with a purple ribbon. In the United States, a 1939 Saks Fifth Avenue catalog featured an elegant woman in a stylized lumber jacket, cinched in at the waist and peaked at the shoulders, made of several hundred moleskins.

At the height of the fashion, Europeans harvested 12 million moles in one year. Germany had to pass legislation to protect moles. But the mole survived, testimony to the success of its isolationist strategy. By reproducing at a low rate, taking advantage of a steady food source, and staying underground where even trappers couldn't get them all, moles populated and then repopulated Europe as thoroughly as humans.

The trade in mole furs is now almost extinct, as is the classic old-time mole catcher, who often bore an uncanny resemblance to the mole itself. Peter Rutherford recalled one such ancient Northumberland trapper, short, squat and dark, who never went to bed but sat up all night in front of a smoking fire, inadvertently acquiring a permanent mole-black patina. He also generally kept a heap of 50 or so moles on the kitchen table, not counting the stretched pelts on the wall. Visitors reported that he tended to skin the carcasses and butter his bread with the same knife.

This is a practice on which Peter Rutherford's girlfriend would frown. In any case, at 39, with a sturdy build, deep-set eyes and a full, honest face, Rutherford was too young to fit the image of the classic mole man. A former miner, he'd just switched over full time to his father's old trade and was barely eking out a living. "It's bloody hell getting money out of farmers," he said, wandering the hills one morning. His $80 bill for a day's work often goes unpaid long enough for him to contemplate enforcement measures: "I'm a good hand at catching live moles, so I can always give them back."

"Poor old mole. It's discrimination"

A more serious problem for Rutherford was that some hill farmers suffered, if not from Wind in the Willowish sympathies, at least from a failure to see the benefit in controlling their moles. They were stuck on the ancient question of just how much damage moles actually do. Doubts on this subject crop up even among mole-murdering integrated pest management specialists, the IPM guys, who have largely replaced old-fashioned mole catchers.

"People are very sympathetic to the mole. I mean, he probably does a lot of good, aerating the soil," said one exterminator, who works the Henley-on-Thames landscape where Mole did most of his wandering. "It's just that he's such an untidy animal, throwing the junk out on top. Poor old mole. It's discrimination." Vanity about our lawns, he added, is the real reason most peo-

ple kill moles. Contrary to the deeply held belief of many gardeners, moles don't eat precious flower bulbs. Gardeners might do better to complain that moles eat earthworms, which would otherwise be enriching their soil. But moles also eat some agricultural pests.

It appears that the only people with a legitimate gripe against moles are small farmers. Though moles rarely eat crops, their tunnels can sometimes dry out an entire row of plant roots or bring in mice, voles or other pests. Their heaps can blacken a pasture, according to an Oregon study, which estimated that dairy farmers in Tillamook County could lose up to a third of their land to moles. British officials in the early 1980s blamed moles for about $3.3 million in annual agricultural damage.

Rutherford indicated a farm across the valley. "That's what I like to see," he said. "That bloke there, I did his fields about five years ago. I gave him the bill and he said, 'That's too much.' Now his fields are absolutely black, and serve the bastard right." He consoled himself with the thought that the moles would spread to the neighboring fields of sensible farmers, who would want them killed. There would never be a shortage of work. The persistence of moles, snug in their earthy homes, guaranteed it.

Then Rutherford told an Irish joke. His listener, being of Irish descent, chose to take it as a remark not on the Irish intellect but on the charmed life of the mole. "This rich Englishman woke up one morning," Rutherford said, "and there was a mole heap in his yard. He couldn't sleep for thinking about it, and he couldn't eat his dinner. So he advertised for a mole catcher.

"It was an Irishman who answered the ad, and he said, 'How much will you give me if I catch the mole?' And the Englishman said, 'I'll give you £500, and when you catch him I want you to give him the worst death you can imagine, because of all the sleepless nights I've had worrying about him.'

"So the next day the Irishman showed up. 'I've caught your mole and I've come to collect my money.' The Englishman asked, 'And what death did you give him?'

"'I gave him the worst death I could possibly imagine,' the Irishman replied. 'I buried him alive.'"

In the Border Country of Northern England, mole nemesis Peter Rutherford surveys another "battlefield." Pasture shows the damage moles inflict when they kick up dirt mounds, or "moldy-tumps," while tunneling.

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Winning the hearts and minds of an America facing war

Fifty years ago, the nation's artists labored to create the unforgettable images that called this country to work toward victory

Rosie the Riveter exemplified the home front heroines who served in the American munitions industry.

It was a time of scanning the skies for enemy planes, of Rosie the Riveter rolling up her shirtsleeves to do a man's job, of eating an egg for breakfast but forgoing the bacon, of gathering around the radio for FDR's sonorous, grave accounts of the latest turns in the war. But above all it was a time of waiting for news from distant battlefields of the safety or the grievous loss of husbands and brothers and sons.

A half-century has passed since Americans lived in the world of courage and endurance that was the home front during the 1940s. It is an era evoked in all its intensity in "Powers of Persuasion: Poster Art from World War II," an exhibition continuing through February 1995 at the National Archives in Washington, D.C., and in a traveling SITES exhibition opening in March in Santa Ana, California. The posters resurrect the images that were part of the fabric of everyday life.

Almost anywhere one happened to be–in post office or train station, school or hospital, factory or canteen–these posters galvanized the nation in its struggle against the enemy. That campaign, to concentrate America's might and mind on the war effort, was orchestrated from the Office of War Information in Washington. The federal government called on artists throughout the nation to join in the work of marshaling public support. From studios across the land, artists both unknown and celebrated–Norman Rockwell, Thomas Hart Benton and Ben Shahn among them–took up pen and sketchbook, oils and watercolors, to create compelling works that remain a testament to patriotic resolve.

Invoking ideal of a nation united in struggle, image emphasized steadfast heroism of the nation's soldiers.

The posters sounded the themes of sacrifice, heroism and united will that were required to carry a nation to victory. Whether exhorting citizens to buy war bonds, conserve resources, labor in the munitions industry or honor American heroes, the underlying message was unwavering. As the forces of fascism engulfed the globe, only our shared exertions could defeat the Axis powers. In shaping a will to win, the posters became weapons.

In taking on this mission, the artists had set themselves a demanding task. They had only a moment to deliver their rallying cry; the image had to be big, bold, instantly apprehensible. To achieve such powerful effects, the posters often relied on the welter of symbols that provided a visual shorthand in the lexicon of war–the American flag, perhaps, or the swastika or a caricature of Hitler. Each poster was the result of a painstaking process: scores of rough renderings and proposed ideas submitted to War Information designers lay behind the final products.

Ultimately, their creations have stood the test of time. Today these emblems of World War II, bearing the stamp of many artists' visions, shape our collective memory of that conflict.

Kathleen Burke

On the home front, we were asked to train every ounce of energy on the war effort. From conserving kitchen grease (left) to facing down Hitler on the weapons production line, everyone from housewife (far right) to retiree was called upon to pitch in, support the troops overseas and help assure victory.

Defeating the enemy required a relentless vigilance: just as Pearl Harbor hero Dorie Miller (far left) risked his life to gun down a Japanese plane, each citizen was called to do his part in stopping the Axis death machine, as depicted by Thomas Hart Benton (left). One poster (right) counseled constant watchfulness.

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By Bruce Watson

In the heyday of men's hats, fashion began at the top

Before hats fell out of favor, the stylish gentleman couldn't own too many, but he usually chose to wear only one at a time

No one knows who started the riot, but police blamed the hat. This was no ordinary hat. This hat, if you could call it that, was tall and black, like a chimney. Its crown, London police noted, had "a luster calculated to frighten timid people." In 1797, when men adorned their heads with tricornes made of brown beaver fur, a gentleman just didn't wear a shiny black hat without consequences. Before the melee was through, it was reported, "several women fainted at the unusual sight, children screamed, dogs yelled." One boy had a broken arm, and haberdasher John Hetherington was under arrest for wearing a silk top hat. Within ten years, silk hats topped men's heads all over Europe.

Some men regard even the finest hats as pure imitation. Seated in his Walden cabin, probably hatless, Henry David Thoreau sneered, "The head monkey at Paris puts on a traveller's cap, and all the monkeys in America do the same." But more than mimicry lies under men's hats.

Until World War II, every well-dressed man wore a hat. Streets teemed with gray fedoras. Seasides swam in straw boaters. But in the postwar years, the hat market shrank like a cheap ski cap, and in the 1960s it collapsed like an opera hat. Hatters blamed John F. Kennedy, but long before JFK went bareheaded at his Inauguration men had grown tired of the ritual, the bother and the cost of the everyday dress hat. Today's headgear is cheap and informal–golf caps, boating caps and the ubiquitous baseball cap worn by Presidents, movie stars, teens, truckers, even baseball players.

To understand men's hats, look at men's heads. As men have evolved, learning to walk upright, use tools, punch a clock and hit a baseball, their heads have changed relatively little. Now as in Neanderthal days, male heads are too bony or too pointed, too square or too ovular, often too hairless and always too naked to the elements. Hence hats. And because the head is the body's center stage, a hat is the exclamation point on a fashion statement. From Humphrey Bogart's fedora to Charlie Chaplin's bowler, from the first Phrygian cap to the cowboy's statuesque Stetson, hats march in a colorful parade featuring status, psychology, even a little linguistics. Allow me to don my historian's hat, and the parade can begin.

Since men discovered portable shade, hats have been shaped like inverted flowerpots, pill boxes, loaves of bread, half-domes, cornucopias, spears, fluffy animals; there have been sombreros as wide as a barrel, skullcaps that barely covered a skull, hats with rims broad and narrow, hats with crowns high and low. No headwear has ever been so eccentric, daring or just plain imbecilic that some man didn't prefer it to the knobs of his bare head. The only rule seems to be Amy Vanderbilt's. "A man's hat should sit more or less squarely on his head," the etiquette expert said, and "should never distort the natural position of his ears."

Put your money where your hat is

During those fashionless years once called the Dark Ages, most men wore hoods, cowls and close-fitting caps. Only during the Renaissance did hats at last begin to flourish in all their variety and vanity. As art is our witness, Renaissance men did not buy their hats off the rack. Some, like Belgian merchant Giovanni Arnolfini in his famous wedding portrait by Van Eyck, wore hats resembling inverted punch bowls. Others wore turbans backed by their own drapes, called "liripipes," that sometimes doubled as a wallet for men whose tights offered no pockets to hold spare coins. Rain and sun must have bothered men incessantly during those years because hat brims were rare, found only among peasant hats. Scholars wore simple black berets, sometimes peaked in the middle, ancestors of the modern mortarboard. Scarlet pillboxes and somber skullcaps were common. Royalty proved their highness not by wearing taller hats, as Napoleon would, but by wearing wider, fancier ones. Henry VIII's hat looked like a huge black

Starting at bottom, leaning tower of men's headwear consists of classic bowler, wide-brimmed plantation hat, homburg, fedora, Panama, black top hat, deerstalker, Irish walker, green baseball cap, tam and sombrero.

Theo Westenberger

Brimless number gives August of Saxony elegant look in mid-1600s portrait by Lucas Cranach the Younger.

Red birettas denote Italian aristocrats in Benozzo Gozzoli's 15th-century painting *Procession of the Magi.*

slug perched on his ample skull, bedecked with jewels and plumage. On him it looked good, or so everyone said. Perhaps a few peasants wanted to shout, "Hey Henry, where'd you get that hat?" but I suspect few did.

When frills and feathers began sprouting from men's headgear, some gentlemen advertised their amours by wearing their lady's glove or garter in their hatband. This parade of preference may explain why modern men wear baseball caps declaring their love for the Yankees, Caterpillar Tractor or Malcolm X.

By the time Elizabeth I came to the throne, hats carried the weight of imperial decree. To please London hatters, in 1570 the queen ordered her subjects to "wear upon the Sabbath and holy day . . . upon their head a cap of wool knit, thicked, and dressed in England." For nearly 30 years, those "statute caps" were not just a good idea, they were the law.

But hats have been more often outlawed than mandated. Puritans, fearing the vanity they called "hat worship," banned beaver hats except among the wealthy. In 1775 Yale University prohibited freshmen from wearing hats in the college yard until after the May vacation. Chinese authorities banned Manchu headgear after their 1911 revolution. And with a single decree in 1928, Turkey's first president, Kemal Ataturk, took millions of fezzes off his citizens' heads. The towering, brimless red caps were icons of the past, Ataturk said. The penalty for wearing a fez: ten years of hard labor. Lest we think such laws are old hat, in 1989 a Chicago high school banned all hats. The target was the baseball cap, which, worn with the bill to the right signaled membership in one gang, and worn to the left, its rival. Before

Black hat gives rakish look to Charles I in Anthony Van Dyck's portrait of king who would later lose his head.

Tricorne tops the head of 18th-century youth in detail from a painting by Jean-Baptiste-Simeon Chardin.

the ban, fights had erupted over caps worn with the bill to the "wrong" side.

And now, as the parade continues, I'll don my sociologist's hat, though it's a little snug about the ears. Hat laws suggest that a good hat is worn for status as much as style. Today men drive their status symbol or make mortgage payments on it, but for centuries a man's standing stood firmly on his head. The hats of specific occupations–soldier, sailor, merchant, scholar–gave their wearers a sense of belonging. Luxurious hats set the wealthy apart from the working class. At the height of hat fashion in the late 19th century, tall, stiff hats meant towering status. Shorter hats, especially the bowler, lent respectability to a wide range of classes. Lower on the hat rack were soft cloth caps worn by working men and boys. Lowest of all was the baseball cap, which, when worn off the diamond by an adult, was a sure sign of a delinquent or a dimwit. Now just about everybody wears baseball caps. Fashion works in strange ways.

Proof that hats fit some classes better than others can be found in a game of musical hats. Picture Charlie Chaplin in a baseball cap or Abraham Lincoln in a fedora. Imagine hat lover Winston Churchill in a cowboy hat, Roy Rogers in a straw boater. Clearly, image, style and status come in sizes that range from 6½ to 7¾, blocked, cocked or plumed.

During some eras, including our own, hair has been man's favorite fashion variable. By the mid-17th century in much of Europe, no gentleman was without a flowing wig of bouffant curls. Neither berets, pillboxes nor skullcaps would stay on such an arrangement, so wigged men wore either a plumed cavalier's hat, cocked in front to improve vision when dueling à la D'Artagnan, or a lofty black hat worn with a buckle instead of a feather, as seen in Rembrandts and Rubenses, and on cigar-box Dutch Masters.

Those hats made history and meant trouble for a flat-tailed, furry mammal living in the wild rivers of North America. It was the beaver's misfortune to have a pelt that could be cured into the finest felt. The animal had long provided a way of life for entire Indian nations, supplying them with the raw material for everything from coats and medicine to moccasins. But starting in the 1600s, French and British trappers, driven by the demand for beaver hats, made a once-plentiful resource scarce. Detroit owes its living to cars, but it owes its existence to hats, as do other cities in the United States and Canada that began as fur-trading forts and outposts: St. Louis, Green Bay, Laramie, Albany, Quebec and Montreal.

For the trapper, fashion's whims made the beaver market even wilder than the woods. When beaver hats were the height of chic, pelt sales tripled in a few years. When war or recession created a bear market for beaver, however, whole frontier warehouses full of pelts were burned to the ground.

No matter how many trappers went West, the demand for beaver hats eventually exceeded the supply. The solution: a blend of water and nitric acid to cure rabbit fur

Since writing this story, Mr. Watson has decided that he looks good in a hat, after all. He now wears either a trilby or a baseball cap, bill forward.

into a finer felt. But cured rabbit fur was not quite fine enough. Then, in the 1750s, an Englishman discovered that a little mercury in the curing solution could make rabbit fur as elegant as beaver. Soon though, hatters had a new headache. Poisoned by the mercury, they showed up in hospitals complaining of nausea and twitching violently. Lawsuits followed, but to no avail. Mercury remained the solution, and the hats that made some men strut with pride made hatters seem a little mad. Today the legend of the mad hatter lives on, principally in the zany personage of the host of the Mad Tea Party in the Lewis Carroll children's book *Alice's Adventures in Wonderland.*

The next mutation in the parade of hats emerged in the 1750s when wide brims were turned up on both sides, creating the tricorne, the hat of Paul Revere, the Minutemen and Yankee Doodle. Millions of children have grown up thinking Yankee Doodle decorated his headgear with their favorite lunch. But when he "stuck a feather in his cap and called it macaroni," the fashion-conscious Mr. Doodle was just trying to mind the music and the step of his times. In the 1770s, English and American dandies wore huge pompadours and fancy hats with plumage, a style called "macaroni."

The tricorne fought on both sides of the American Revolution, but by the French Revolution, it was the hat of the status quo. To declare their independence, French radicals wore a red bonnet, a variation of the cap given to freed Roman slaves. Long a symbol of liberty, the *bonnet rouge* became the badge of loyalty among Jacobins struggling to lop the tricornes off royalists. The next to last indignity for Louis XVI came when his captors stuck a bonnet rouge on his head before a roaring crowd. Later, Napoleon, who knew the importance of the right hat, banned the bonnet rouge.

Fashionable spectators sport top hats at a hunt near Wiltshire, England–not far from Stonehenge–in 1840s.

Off with wigs, on with top hats

Amid all this ado about bonnets, beavers and tricornes, John Hetherington calculated the luster of his hat "to frighten timid people." The shape of his first top hat was nothing new. British aristocrats had worn tall beaver hats for a few decades. Shiny silk was the shocker. But despite the initial riot, Hetherington's timing was as exquisite as his hat. A tax on hair powder had caused English gentlemen to doff their wigs. French citizens had already done the same in haste to jettison all things royal. Naked without their piles of hair, men searched again for portable status and style. Enter the Century of the Top Hat.

At first, toppers met with some resistance from beaver loyalists, but a few magic tricks overcame most objections. Hate to carry the ungainly thing indoors? Presto! In 1823 the collapsible opera hat was invented. Worried that it looks too much like a smokestack? Wear it with

Boater shades man in detail from *Boating*, Edouard Manet's 1874 painting of a pair enjoying sunny outing.

After some initial resistance, the "topper" became an indispensable part of the stylish gentleman's wardrobe.

In 1962 painting, artist Magritte used bowler, the hat of the middle class, to symbolize bland conformity.

the flared crown that was introduced in the 1820s. About that same time, a French magician became the first man to pull a white rabbit out of his hat. For the rest of the century, the top hat was tops in men's fashion. Never mind that wearing the shellacked cylinder felt like wearing an empty tin can. Forget that some scientists worried about top hats causing baldness. Fashion had to be served.

With the Industrial Revolution came the golden years of the hat parade. As men fled farms for factories, they opened an unprecedented market for Sunday and social headwear, but the search for a better hat actually began in 1850 with the bowler. Needing a hard hat to protect his gamekeepers from falling branches, William Coke II, a London aristocrat, commissioned the bowler, or as some called it, the "iron hat." To test its shellacked hardness, Coke put the first bowler on the floor and stomped on it. It didn't give an inch. Now *this* was a hat for the Industrial Age! For the better part of a century, the sun never set on the British bowler, symbol of Her Majesty's minions. "The bowler hat made Britain great," *The Times* of London wrote in 1986. "The empire was won by men in bowler hats, the Industrial Revolution would never have happened without the bowler hat."

In America, the bowler was worn by East Coast urbanites and at horse races, where it earned the name "derby." But out West, men needed a hat in which they could feel at home on the range. And the hat that won the West supposedly got its start on the lone prairie.

How the cowboy hat was born

To improve his health, John B. Stetson, the asthmatic son of a New Jersey hatmaker, took his first trip West in 1865. En route to Pike's Peak, Stetson, weakened by harsh weather, bought some beaver and rabbit skins. While his traveling companions watched, he shaved off the fur, kneaded it into a thin sheet of felt, tightened it by dipping it into boiling water and shaped it with his own hands. Like the Mexican sombrero, Stetson's hat had a broad brim for protection from the sun. Like the top hat, it had a tall crown, all the better to hold water. Legend says that Stetson's hat held ten gallons, though in fact most hold only a few quarts. But the hat was practical, water repellent, crushable, with a brim large enough to fold around a cowboy's face in wind or frost. After selling his first model to a wagon driver for $5, Stetson returned to New Jersey to begin mass-producing the hat that still bears his name.

Once they had their own hats, cowboys of the Old West wore them with esteem and a little arrogance. Stories tell of cowboys whooping it up when some "silk hat" rode into town, shooting such hats full of holes without waiting for them to be removed from the wearer's head. And ranchers who wore a derby to please a wife did not

Picture in 1861 handbook of French shop signs shows racks displaying civilian and military headwear.

live it down for years. Even today, the cowboy hat is the last surviving dress hat that men out West wear daily with pride.

During the Gilded Age, new hat styles were introduced every decade or so. Some were popularized by British plays. The fedora, for example, was first worn by the divine Sarah Bernhardt in the 1882 drama *Fedora.* The trilby, a soft felt fedora with a tapered crown, came from an 1895 play of the same name (SMITHSONIAN, December 1993). Had this trend passed to the American stage, our favorite hats might be named "The Iceman Cometh" or "Our Town." But during this fertile era of new hats, drama was a minor style-setter compared with the ways of one man.

"Extra! Extra!" shouted a British newspaper in 1896. "The news has gone from one end of Wood Street to the other that the Prince of Wales has purchased a boater and will wear it for the rest of the season." For an entire generation, the Prince of Wales, later Edward VII, was the fashion plate of the Western world. In 1890 he visited the German spa at Bad Homburg and returned wearing a funny hat with a dented crown. Millions of men bought homburgs. When he put on a boater for summer, men everywhere put on boaters. He quashed the Panama hat by refusing to wear it. His grandson Edward VIII, also quite a clotheshorse, popularized the Tyrolean hat in the 1930s. To explain this behavior, I will now don my psychologist's hat.

It's not hard to guess what Freud thought of hats. Hats, he said, were "a symbol of the genital organ, most frequently the male." Freud's thesis may define a few hats, notably those worn to great heights by Napoleon or the peaked caps worn by Latin American generals. But the motives of most men whose hats have no hint of the phallic were perhaps best described by Carl Jung, who saw hats as personality caps. "Just as in summing up we bring ideas 'under one head,' so the hat, as a sort of leading idea, covers the whole personality and imparts its own significance to it," Jung wrote.

A mail-order hat for every occasion

A hat, unlike the rest of a man's wardrobe, is as swiftly swapped as a mood. And by the turn of the 19th century, men could don a different mood every day for weeks without ever wearing the same hat twice. Sears, Roebuck's 1897 catalog offered more than 60 hats and caps. They included the "Citizen's Hat," a felt homburg, and the "Bike Hat," to be worn while pursuing the Gay Nineties bicycle craze. The "Nutria Fur Hat" was made of a South American rodent "resembling the beaver but much more plentiful." Sears sold "Canton Straw Hats" for a quarter and "Ranch Hats" for 50 cents. "Our Great Danbury Hat," made in the country's hatmaking center, Danbury, Connecticut, sold for $1.69.

The American fin de siècle offered a hat for every style, and with every man wearing one, hats became popular metaphors. Even if you owned only one hat, you could take the latest gossip and "keep it under your hat." You might "take your hat off" to a hero or "throw your hat in the air" to celebrate. If you didn't know what you were talking about, you were "talking through your hat." A drunk "had a brick in his hat." A "bad hat" was a bad man, and once Westerns came along everyone knew the good guys by their white hats. "Hang on to your hat" because any of these phrases might change "at the drop of a hat." Need money for a new hat? You could "pass the hat." Or you could risk it all by "betting your hat." Some hats became class trademarks–"high hats," "brass hats," "hard hats," even "wool hats," a term for bumpkins. Finally, for the sports fan there was that rare feat the "hat trick": three goals in a single game. These days it occurs in hockey and soccer, but it originated in British cricket; three goals in a game earned the scorer a hat from the local club.

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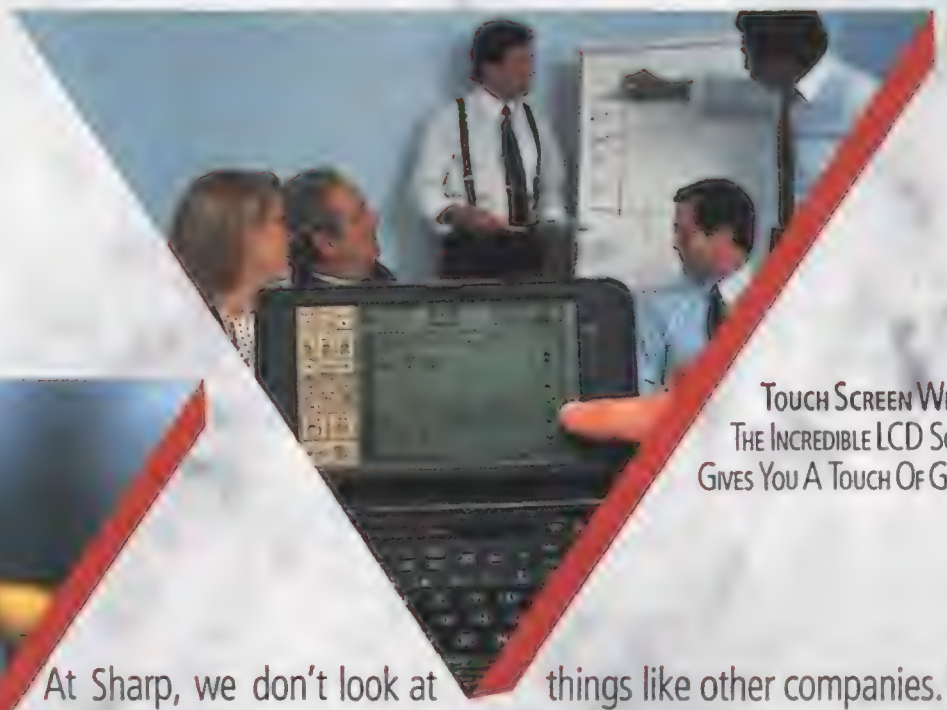

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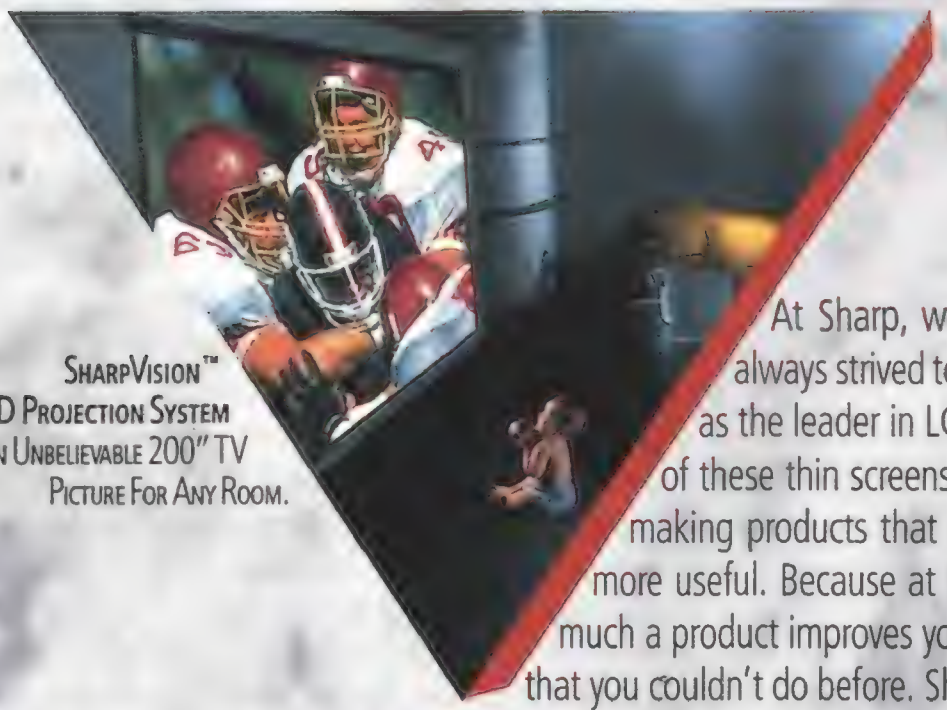

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Dapper strollers in a 1938 fashion ad illustrate variations on a theme: gray flannel suits–and fedoras.

The last major innovation in hats has been one of the most enduring, but mislabeled. Panama hats were never made in Panama. The hat was widely worn by Panamanians in the 19th century, when European sailors christened it. The name and the hat caught on when Teddy Roosevelt wore one while viewing the Panama Canal in progress. Panamas are made in Ecuador, where the finest, the Montecristi finos, sell for up to $3,000. At these prices, Roosevelt, who later would become the first candidate to "throw his hat in the ring," might have thought twice.

For the first half of this century, no well-dressed man would have considered going out without some kind of hat. Between the world wars, *Esquire* magazine decreed that a man should have eight hats, including an English snap brim for fall; a college-style snap brim with a low crown and a wide brim, then popular on campus; a bowler for business; a midnight blue homburg for stylish occasions; a brown porkpie hat for country wear; a Tyrolean hat with a feather, for football games; a "correct cap" for golf; and a midnight blue silk top hat for opera and high society. Hats were so prevalent that you could even dine inside one–at the Brown Derby restaurant in Los Angeles.

Thriving on men's vanity, hatters thought the parade would never end. Then, during World War II, the obligatory man's hat began to vanish. There were surges and resurgent styles. President Dwight Eisenhower gave the homburg a boost by wearing it, instead of the traditional top hat, to his first Inaugural. But in the next 30 years, more than 700 of the nation's 800 hat firms closed, and countless hatcheck girls went looking for other work, hat in hand. Blame it on JFK, as did unemployed Danbury hatters. Blame it on the shift to younger style-setters like the Beatles. Blame it on increasing hair consciousness. But like the London police targeting John Hetherington's top hat, at least one expert blames hats themselves. "Formal hats were always solid-color items–if you were wearing brown, you couldn't wear a black or gray hat," says C. Leon Sherman, a Denver-based consultant to the headwear industry. "You needed a number of them, and they were too expensive. If some hats got wet, they were ruined. Hats blew off your head. They were hard to carry. Face it, hats just weren't easy to work with."

The era of the baseball cap

So long as men lose hair, lose face without the latest fashion and lose heat from a bare head, some form of hat will be worn. Today an estimated 50 percent of the annual $1 billion hat industry comes from sales of baseball caps. Nearly 500 million of these caps are sold each year, with logos that range from "Smithsonian" to the names of rap groups. "Baseball caps are the new T-shirts," the *New York Times* declared recently, and the trend has yet to abate.

Those who dare to wear something other than a baseball cap make hats part of a costume. For a generation that knows the past primarily through old movies, each hat is a time machine. Put on a fedora, tilt it like Bogart's, and you're in *Casablanca*, one of the great hat movies, which also featured Sydney Greenstreet's Panama, Claude Raines' kepi, Ingrid Bergman's white lampshade hat and a lot of fezzes in between. Wear a Panama and you're in the early 1900s. A boater takes you back to the 1890s. A beret turns you into Jean-Paul Sartre. Don a coconut straw and you're Bing Crosby. "It does something to a man," the late trumpeter Miles Davis said of a hat. "It completes his whole thing."

The hat parade ends at one of the nation's largest hat stores, Worth & Worth in Manhattan. Here hats still make the man and, for about a fifth of the store's customers, including Madonna and Mary Tyler Moore, the woman. Yes, many men still buy many hats, says assistant manager Mark Baum. But many more pause, look in the

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window and walk on, afraid they'll look silly in a hat these days.

"Some men come in here with a bit of hesitation," says Baum, a dapper thirtysomething man who owns a Montecristi Panama and two fedoras. "They think they'll feel too pretentious wearing a hat. But once men get used to hats, that modesty fades very quickly, and they come back to see if we have anything different. They get hooked and build up a collection." Like other hat dealers, Worth & Worth rides fashion's roller coaster, driven now by celebrities rather than royalty. When Harrison Ford, one of the store's occasional customers, wore a fedora in the movie *Raiders of the Lost Ark*, men asked for a "Raiders Hat." When the movie *Urban Cowboy* was popular, it was Stetsons. These days, it's whatever you can get away with.

Worth & Worth's 4,000 hats line three walls, fill several drawers and are showcased in freestanding cabinets. There are cool blue fedoras, dark brown Stetsons, the finest Panamas. I have my eye on a somber tobacco-hued fedora. I try it on. Until now, I've never noticed the similarity between myself and Bogart. Next I don a beret and feel existential. I try on a Panama that makes me look like Teddy Roosevelt. But in the end, I buy nothing and leave the store bareheaded. I look silly in a hat, anyway.

Hats may never return to their former glory, but who knows? In fashion it's wise never to say never. Styles repeat themselves, first as trend, then as farce, finally as icon. In a century, the bowler went from required attire to the prop of Chaplin and Laurel & Hardy, finally becoming a symbol of conformity in the paintings of René Magritte. The top hat, which gave élan to a whole century, became a joke when worn by Harpo Marx and then an icon on the head of Fred Astaire. In our accelerated culture, the same is already happening to the baseball cap. It reached the height of chic in 1991 when Manhattan's Chanel Boutique sold a quilted leather version for $810. Now it's worn by millions of teens who farcically turn the bill backward. And with time, as it becomes an icon of our age, the baseball cap, too, will go the way of all felt. So the parade marches on. Hats off!

Some people just don't look right in the wrong hat. The misfits (clockwise, from left): Charlie Chaplin in a baseball cap, Winston Churchill in a cowboy hat, Abraham Lincoln in a fedora, Roy Rogers in a bowler.

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By Helen Dudar

Beatrice Wood in her second century: still going strong

She is playfully called the Mama of Dada, in reference to an earlier incarnation; now, she has evolved into a celebrated ceramist

Beatrice Wood, a magic hand at crafting sinuous pots and luminous glazes, a stellar figure among contemporary ceramists, a name known to collectors and museums here and abroad, an artist whose works command prices that spiral to five large figures, a woman so wed to her craft that she is at her wheel every morning before she is out of her nightgown–before breakfast, before the sacrosanct period reserved for silent meditation–Beatrice Wood says she would give it all up in a minute for the love and devotion of a man. Preferably young. And of course, handsome.

Never mind that the visitors guide for Ojai lists her studio as a "Point of Interest," a notable tourist attraction of that scenic California town; or that in one of several books bearing her name she reported that, more than anything in the world, she longed to be a "great artist"; or that March 3 marks the 101st year since her birth; or that for the birthday month her work will be on display at the New York and Los Angeles galleries of her dealer, Garth Clark. In the teeth of a convention that insists that passion surely withers with age, Beatrice Wood is passionate witness to the fact that the heart's quest for romance never dies. Or, in her own words, delivered with a ripple of enveloping laughter, "If a man says he loves me, I fall into his lap like a ripe grape."

It is of more than passing interest that some of her opinions are to be found in pretty much the same language in half a hundred published interviews. The casual researcher might conclude that she is taking refuge in safe, remembered language; in fact, five minutes in her presence is sufficient for one to realize that Beatrice Wood is forever a woman of the theater. In her youth, she acted on the stage and on the vaudeville circuit in a career driven less by artistic yearning than by a serious need to escape a controlling, socially ambitious mother. Beatrice Wood knows from experience that you don't tinker with a good line.

Striking evidence of her dramatic art is to be observed in *Beatrice Wood: Mama of Dada*, an hourlong documentary on her life, loves and work filmed when she was 98 years old and shown on public television last year. There she was to be seen and heard delivering lines with fine shadings and theatrically astute pauses that belie her insistence that she was no great shakes as an actress. And the producer-director Tom Neff recalls how, with perfect calm, she would break off in mid-anecdote while the camera was reloaded, and then resume her narrative with seamless precision.

When Neff showed her a finished print, he asked, "Well, what do you think?"

"Well," she said, "I think it's a great film except for the lousy subject matter. Too much on me."

Neff was hoping to get her on the *Tonight Show with Jay Leno* to promote the documentary and asked her, "Is that all right with you?" Wood has never lost her pleasure in or timing for adroit one-liners. Without missing a beat, she replied, "Yes. But I won't sleep with him."

Now, as to the *Mama of Dada*. It's a catchy title but a role Wood properly disclaims. She was more like an accidental tourist, a questing but barely cultivated mind and spirit waiting to be seeded, a fugitive from social conventions. Freedom beckoned from a group of cultural renegades who were fomenting what would be a genuine revolution in the arts–New York Dada, a movement bent on demolishing all the old rules.

The dominant figure was Marcel Duchamp, who had scandalized the art world in 1913 with his masterful *Nude Descending a Staircase* and would cause earthquake-scale tremors with his proposal that a urinal turned upside down and called *Fountain* could be a piece of sculpture commanding attention. Duchamp and circle were sitting out World War I in New York when Wood, an eager little creature with smoky blue eyes and a full, provocative mouth, fell into their company.

For a few years she, Duchamp and Duchamp's friend Henri-Pierre Roché, a writer who was in the French diplomatic service, were a threesome. The two men essentially educated her. They involved her in avant-garde events that were to become indelible elements of this century's cultural history: a splendidly irregular art

At home in Ojai, California, Beatrice Wood wears her everyday clothing–jewelry and a sari from India.

Wood–here, with her mother on a 1903 trip to Paris–found her wealthy life stultifying and sought escape.

At Coney Island (1917) Wood posed with Dada artists Marcel Duchamp, who was her lover, and Francis Picabia.

show of "Independents," a short-lived, tradition-bashing magazine of the arts perversely called *The Blind Man*, evenings among the literati at the Manhattan apartment of Walter and Louise Arensberg, two of the earliest serious American patrons of the new art. Wood had once, briefly, studied drawing, and with Duchamp's encouragement began producing the first of hundreds of spare, witty sketches that now form a kind of seven-decade pictorial diary and have found their way into museum shows. Roché became her first lover, and when she felt betrayed by his casual involvement with a woman friend of hers, Duchamp replaced him.

To this day, Wood, clinging to the vintage phraseology of an earlier time, speaks of Roché as one of the three men in her life who "broke my heart" (or, more vividly, "When the bowl that was my heart was broken, laughter fell out"). She is not, however, greatly impressed that, years after their romance, he immortalized the Duchamp-Wood-Roché trio in his novel *Jules et Jim*, which, in outline at least, recalls their triumvirate. Later, the book became a celebrated François Truffaut film; Wood, having known the real thing, found it boring.

So here she is, shoeless, with rings on her toes, her body wrapped in one of her 50 beautiful saris, costuming she took to after several trips to India. As usual, she is festooned with pounds of jingling Indian jewelry. The walk is slow, the back somewhat bent by a spinal problem that has periodically caused her great misery for much of her adult life. Hearing aids are hidden by abundant hair. Her speaking voice has the cracked timbre-less sound associated with age, but when she

After the Dada years, Wood lived briefly with director Reginald Pole, one of her life's "three great loves."

In a class at Hollywood High School, Wood, in her 40s, examines a partially dried bowl on the potter's wheel.

laughs–and she does the minute she has said something that could be considered mildly naughty–the sound that emerges is an engaging girlish giggle.

In her heart, Beatrice Wood is forever 32 years old. The secret of a long, productive life is probably insoluble, but let's give it a try. Only consider the benefits of a lifelong addiction to "chocolate and young men." Moreover, she has never smoked or consumed spirits. Since the age of 16, she has, out of tender feelings for living creatures, consumed only vegetarian dishes–and, of course, desserts. She has been married twice, both times for convenience and neither time happily. It may be significant that she seems to have no gift for rancor.

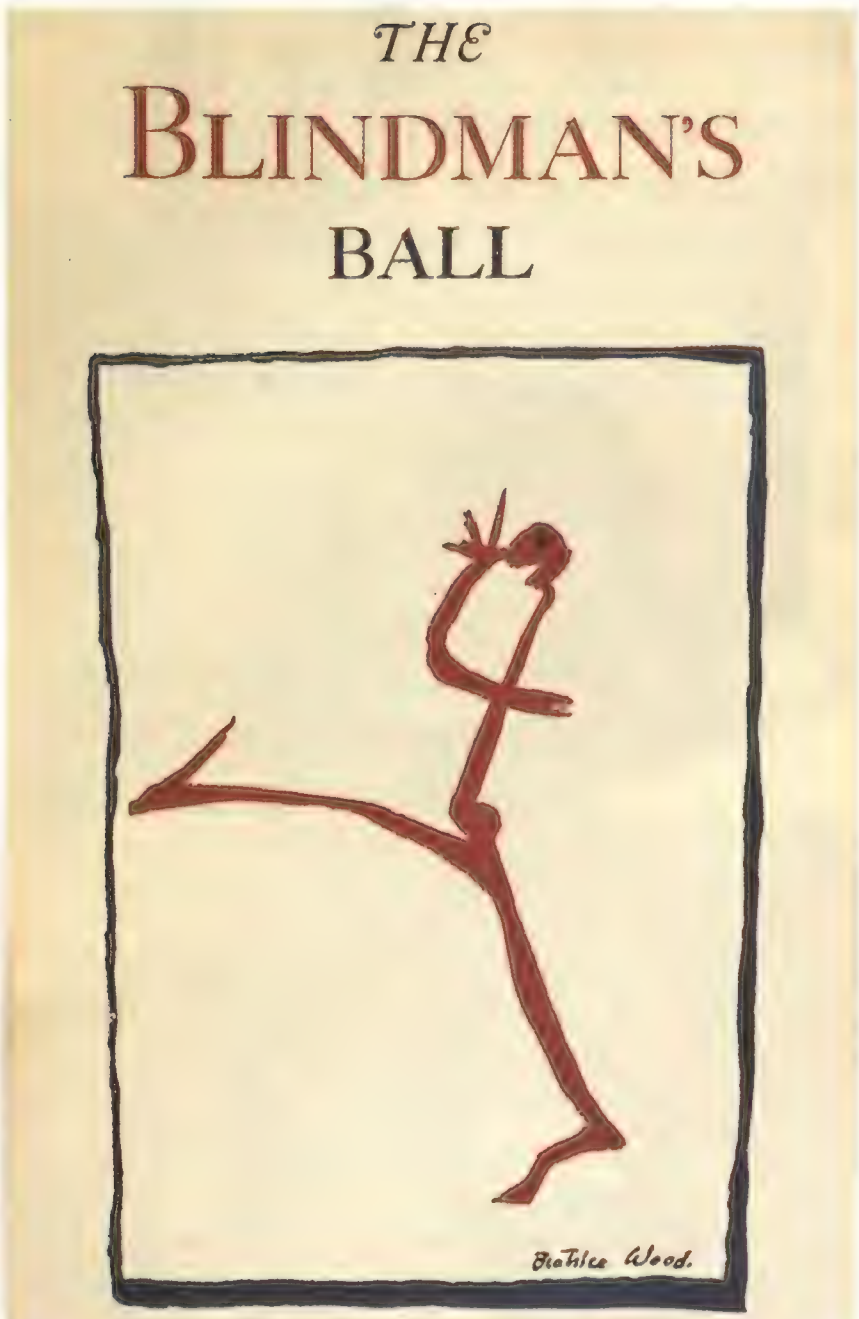
Beatrice Wood came to Ojai 46 years ago in quest of spiritual guidance offered by two earlier settlers, Dr. Annie Besant, the English theosophist, and Jiddu Krishnamurti, the Indian philosopher, both of whom she knew. A valley town 70 miles north of Los Angeles, Ojai is a happy surprise; it has managed to hold on to its tranquillity while becoming a model of rural chic. Modern Ojai is a popular resort, a refuge for retirees, home to a string of select private schools, and magnet for a thriving assortment of merchants of arts, crafts, clothing and self-improvement.

Wood's place is on the outskirts of Ojai, a mountain away from the center of town; it is a modest home-cum-studio, surrounded by a garden of spectacular cactus plants and crammed with the folk arts of India, one of her abiding interests. Until recently, 300 tourists arrived at the doorstep each month. Since her widely publicized 100th birthday and the telecasts of *Mama of Dada*, the number has edged up to 400. What they see is Wood herself, wedged into a corner of a couch, surrounded by stacks of books and magazines as well as the materials for her sketch work; two large, quarrelsome dogs of uncertain ancestry; a small table offering her published works for sale, including her autobiography, *I Shock Myself*, and, displayed in glass cases along three walls, the products of her wheel, hand, kiln and sensibility.

Eternally a contradiction, this woman who came of age at the dawn of the new modernity makes pots that might have been dug up from the burial places of long-vanished civilizations. The vessels, frequently classical in form, are opulent–chalices often wear multiple handles that make them seem to be on the verge of becoming living things. Interestingly enough, the pieces are seldom faultless. Garth Clark, who is also an art historian of ceramics, likes to say that "Beatrice is not a great craftsman; she is a great artist."

Wood came late to the potter's wheel, and the trained eye can find slight wobbles in the wheel marks. No authoritative figure seems to object seriously to these minor defects. On the other hand, forever on the prowl for self-improvement, Wood recently persuaded a young visiting potter to give her a few pointers to improve her technique on the wheel. (Why not? This is, after all, a woman who, 11 years ago, acquired a word processor to deal with her large correspondence.)

Frequent contributor Helen Dudar's most recent article for SMITHSONIAN *was on the renovations to the Louvre, in December 1993. She wrote on Jean Dubuffet last June.*



Marcel Duchamp chose Wood's playful sketch for poster advertising a 1917 costume ball in Greenwich Village.

Footed Bowl with Figures, just over six inches high, typifies the iridescent surfaces that Wood achieves.

Her glazes are what lend a Wood piece its special distinction. From the beginning of her venture into ceramics, Wood was first fascinated by and then obsessed with creating luster glazes. Lusters are not new to ceramics, but they are fraught with treachery: the technique of mixing and firing the glaze compounds is rarely foolproof. On the other hand, uncertainty and surprise are elements of the process. As Clark notes, "Beatrice is a risk taker." When everything works–when the chemical mix is right and the firing is ideal–the results are brilliant, iridescent surfaces, a shining array of colors that appear simultaneously to reflect and radiate light.

For a change of pace–"naughty figures"

There is a second strain to Wood's work with clay: when she tires of making pots, she abandons the wheel for a spell and goes to work sculpting small, often comical replicas of humans or, as she likes to call them, "naughty figures." These are folk art pieces for which she has more recently drawn museum attention and a separate measure of fame; they may be single figures or groups of figures or images incised in tile. What they have in common are her lively humor and unblemished gift for biting commentary. Most recently, the glass case in the showroom offered a small work consisting of three naked ladies stonily perched on the prone form of a clothed, bewildered-looking man. It is called *Career Women*. In an earlier piece, she dressed a young woman in ankle-high boots, long gloves and a large flowered hat, leaving the rest of the body unclothed. Its title: *Is My Hat on Straight?*

This is the sort of imagery and humor that would have surely distressed Beatrice Wood's extremely proper mother, who cared deeply about such matters as handmade lace on underwear. The Wood family came from San Francisco, where Beatrice was born, and lived mostly in New York, sustained by substantial real estate holdings. The material benefits included a governess and later a lady's maid, a home packed with antiques, and annual summer trips to Europe. The Woods' daughter, one of two children, had a spell in a French convent school–just long enough for her to acquire fluency in the language. She was further educated at several of the best American private schools, where she never entirely learned to spell, and was subject to the unwelcome process of a full-scale debutante's introduction to society. She escaped by taking acting lessons, finding work as an ingenue in French theater companies which, at the time, flourished in New York and Montreal; and by falling in with the Duchamp crowd.

After the New York Dada period, there were hard times and good times. She began visiting Los Angeles and eventually moved there. She had five good years with Reginald Pole, a baroquely handsome Briton who

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With a youthful love of the naughty, Wood frequently turns out hand-built works like *Is My Hat on Straight?*

An earthenware work with her trademark luster glaze, *Blue and Gold Chalice* (1987) evokes Old World forms.

was a multitalented theater figure; he left her to marry a teenage girl. She met Krishnamurti and became a follower. Indeed, she appears to have met half the seminal figures of her day. A woman of exceptionally orderly habits, Wood has kept a brief, daily record of her activities since 1915. Francis M. Naumann, an art historian whose scholarly studies have leapt beyond New York Dada to encompass the work of Beatrice Wood, has had access to several volumes of her diaries and found the pages festooned with such tantalizing one-line notes as "Tie-dyed scarves today for Isadora Duncan."

The transformation of Wood's life began in 1930 when she traveled to the Netherlands to take part in a Krishnamurti study project. Browsing in an antique shop in Haarlem, she found a half-dozen lusterware plates. When she came home, she gave some thought to matching a teapot to the plates. Finally, in 1933, she set out to learn how to make one in a ceramics course at Hollywood High School. The job demanded far more than a beginner's enthusiasm. Her first finished works were little modeled figures that were admired and actually brought in some small change. She was hooked. She went on to study with a few fine potters and to work obsessively at refining her technique at the wheel. In a few years, posh department stores were selling Wood pottery, and museums as well as galleries were putting her pieces on display.

After all these years, she might be expected to repeat herself and would be forgiven if she did. Garth Clark, who has shown her work since 1981, says that one of the striking things about it is that in the past decade she has been more innovative than ever with both form and decoration. In Wood's private world, whatever success she has now has been forged out of the difficult times of her early years. All art, she insists, is neurotic activity. As she put it one day recently: "Anybody who pours themselves into art, I don't think has had a happy childhood. Every child does decoration. But when you read the early lives of artists, all that I know of have been tortured mentally at some time in their lives."

A quarrel a day to buoy the spirit

Still, nowadays, Ram Pravesh Singh insists that "Beatrice is having a helluva time." Singh, 73, is part of a small staff that sees to it that her days and nights are free of worry. They met in 1961 on the first of her three trips to India, when she was officially invited to show her work throughout the country. Singh, who was with the American diplomatic service in Calcutta, came to work for her almost 20 years ago and functions as her associate, manager and sparring partner.

Together they are a long-running act engaged in ritual wrangling; they usually manage at least one quarrel a day, which seems to buoy or revive their spirits. In con-

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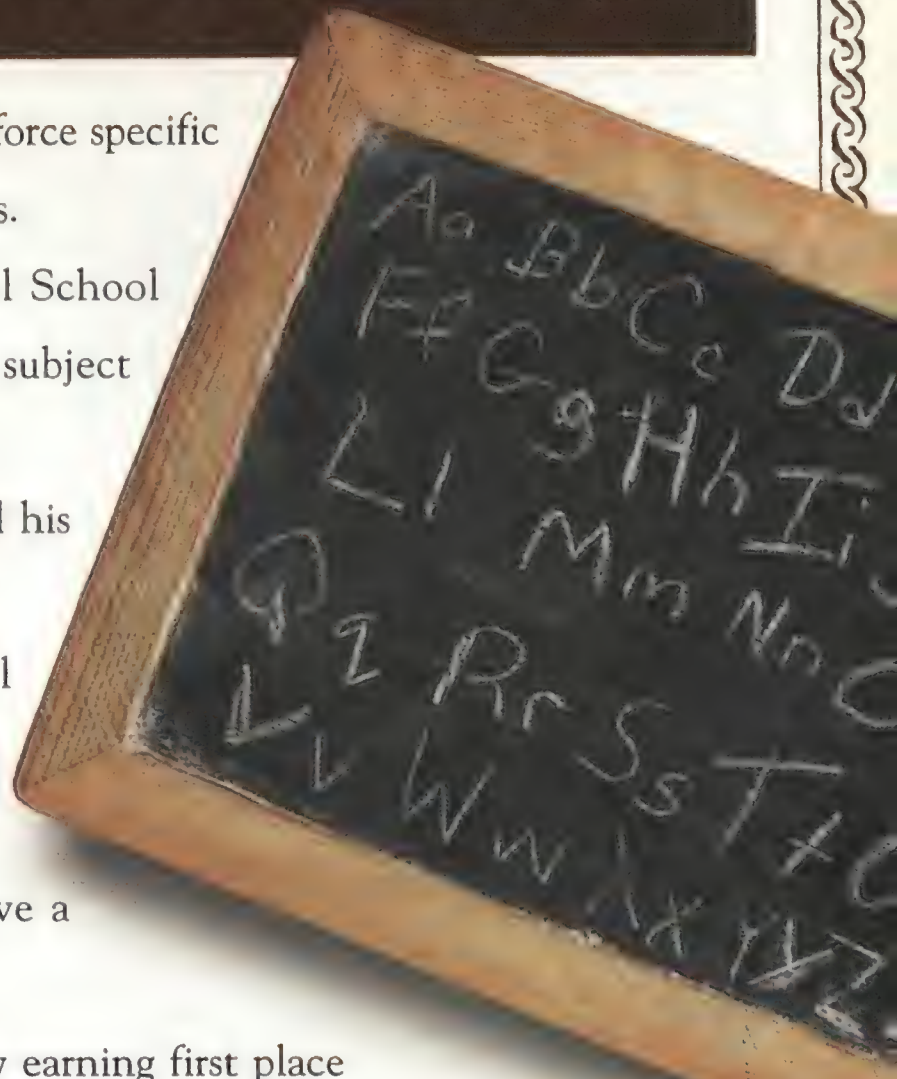

Drexel Sammons uses a variety of games to reinforce specific learning objectives in his sixth grade Social Studies class.

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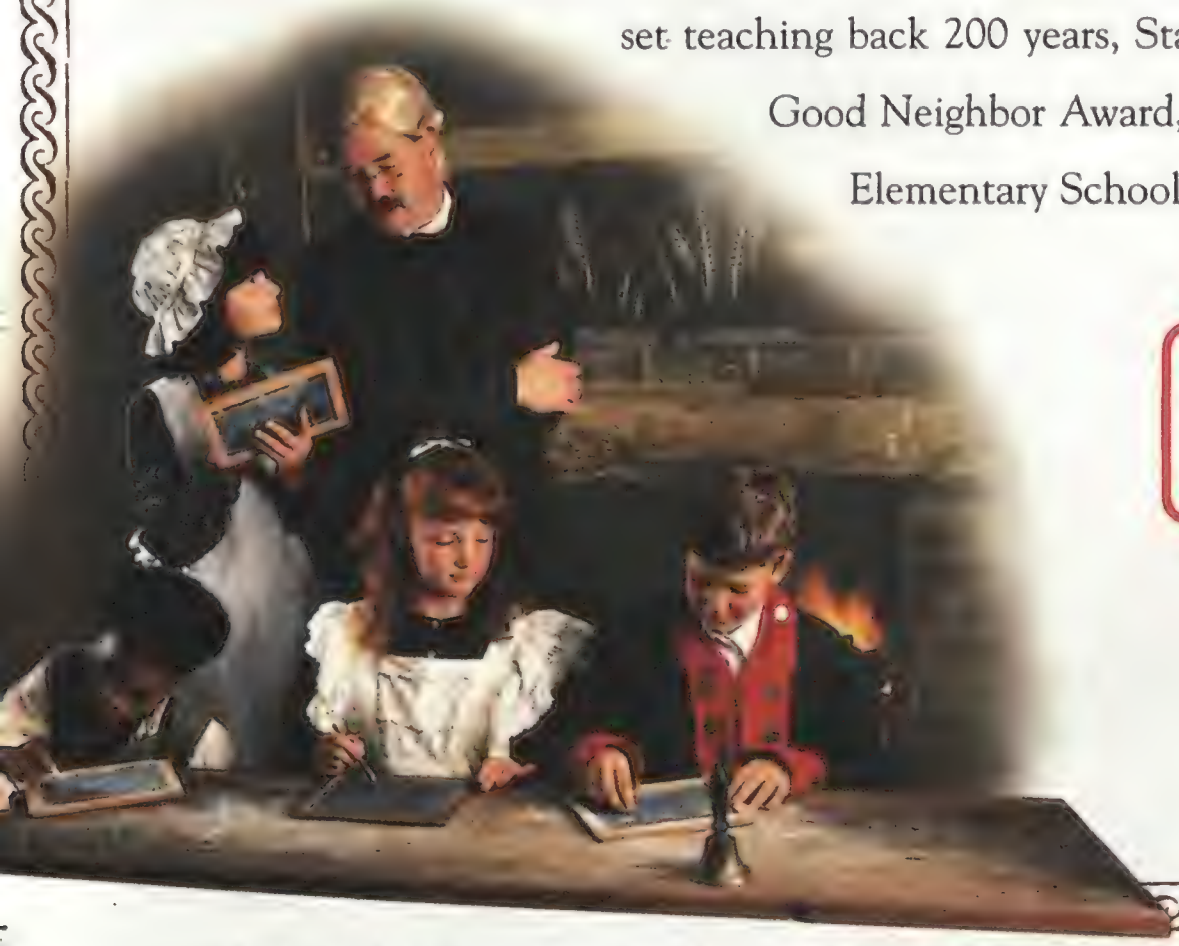

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versation with a visitor one day, she uses "careful" when she means "careless." He corrects her and tells her she has used the "wrong word."

"Well, what of it?" she replies sweetly. "I'm a hundred. I can say anything I want. I'm not supposed to speak clearly."

"Why don't you say what you mean?" he demands.

"But I rarely do. I'm much too smart," she counters.

Her days are fanatically scheduled. She feels she must be present in the showroom when visitors are present; later, after they are gone, part of each evening is set aside for a second workshop session. Then, a half-hour is allocated to one of her two cats, Coco, a needy creature requiring regular rations of attention. Coco curls up purring on her lap while Wood reads aloud to her from magazines as well as books of biography and philosophy. Occasionally Wood "cheats" with an Agatha Christie mystery. She is indifferent to almost everything on television except Ted Koppel's *Nightline* and, cheating again, *Perry Mason.*

Some days she will matter-of-factly report that her energies are waning and speak of the probability that she will not be able to produce the dozens of new objects required for her next gallery exhibitions. But the last time Garth Clark suggested she take it easy–the two galleries could always show her less-current pieces–she let a moment go by and then said sternly, "Don't you ever say that to me again."

To be sure, Beatrice Wood is aware that time is running out. As she told Francis Naumann a few years ago, there are moments when she feels very tired and thinks, "Now my heart's going to stop beating and I'm going to die. Great!" Then she remembers three or four pieces she has been thinking about and wants to make before she departs. Suddenly her heart is beating strongly. "And I'm back."

A whimsical piece inspired by the folk art of India, *To the White House* was sculpted in 1987 as a protest against government cuts in the arts; rider depicts Nancy Reagan on this side, Ronald Reagan on the other.

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By John Dornberg

A 700-year-old mine in Poland is a shrine to human ingenuity

Truth is far stranger than fiction in this underground world, where even the chapels' crystal chandeliers are carved from salt

Renata Swiderska, a cheerful, rotund woman wearing a dark blue duster, her white hard hat perched comically on her mop of curly hair, reeled off encyclopedic facts as we descended a dimly lighted wooden stairwell–54 flights and 380 muscle-cramping steps in all–into the depths of the Wieliczka Salt Mine in southern Poland.

"Seven centuries of continuous mining . . . ten million cubic yards all dug out by hand . . . nine levels going down to 1,100 feet . . . an underground universe with more than 2,000 chambers and caverns . . . 125 miles of galleries and headings . . . you need maps to get around . . . to walk and climb it all would take weeks," she was saying as I felt the temperature dropping perceptibly from 82 degrees aboveground to the constant 57 in the mine, the humidity rising to more than 90 percent, and my lungs clearing as I inhaled the damp, salty air.

No statistics, regardless of how astonishing, could have prepared me for the two-mile hike through this unique netherworld–an operating salt mine, museum of mining technology, repository of amateur art and dazzling show of natural phenomena all wrapped into one. Swiderska, one of the mine employees who double as guides, led the way through a complex of long tunnels, their ceilings glistening with spaghetti-like stalactites and cauliflower-shaped clumps of salt crystals.

We passed through one cavern after another, excavated by generations of miners with backbreaking labor but now eerily silent. There was not the faintest vibration in the air; it was the kind of hush that one imagines in outer space. Then on to immense man-made caves

The Virgin Mary (opposite) is one of many artworks sculpted in salt over the centuries by talented miners.

As this 18th-century engraving shows, horses–which lived in the mine–were a key premodern power source.

the size of a concert hall or gymnasium. Their vaulted roofs and walls of rock and salt had been shored up by intricate webworks of huge timbers resembling honeycombs, basketry and long rows of organ pipes.

We trod a narrow wooden walkway to the edge of a deep green lake–more briny, I was told, than either the Dead Sea or Utah's Great Salt Lake. Its surface, artificially agitated by a gurgling pump mechanism, cast rippling reflections on the jagged walls and ceiling of the cavern. After negotiating another tunnel we entered a series of grottoes and chambers where, over the centuries, artistic miners have created sculptures out of salt. We passed by statues and monuments paying homage to various kings and national heroes of Poland, and life-size ensembles depicting gnomes, mining legends and fairy tales. Then we reached the most impressive and remarkable chambers in this incredible underworld–three large chapels, brilliantly bathed in the magical light of magnificent salt-crystal chandeliers. The largest one is still used for religious services.

All of this underground grandeur hides, like a Brobdingnagian chunk of Swiss cheese, beneath Wieliczka, some eight miles southeast of Krakow. This none-too-prosperous industrial community of 18,000 is indistinguishable from many others in Poland. The facades of its two Baroque churches are grimy from pollutants coughed up by nearby factory smokestacks, and potholes mar the cobblestone streets. When summer winds blow–which they do often here, in the undulating foothills of the Carpathians–they churn up billows of dust that leave a gritty patina on houses and inhabitants alike.

But for centuries the mine has attracted droves of visitors, including some of the most powerful and illustrious figures of history. Among them have been emperors, kings, princes and presidents; the astronomer Nicolaus Copernicus, the naturalist Alexander von Humboldt and the chemist Dmitri Mendeleev; men of letters like Goethe and Balzac; the composer Frederic Chopin and the pianist Jan Paderewski; even Robert Baden-Powell, the founder of the Boy Scouts movement.

Photographs by Chris Sattlberger/ Regina Maria Anzenberger

Tableaus carved in salt in subterranean chambers depict the mine's history–both real and legendary.

More than 100 died in 1510 fire; here, in 19th-century oil, doomed director and deputy cling to hoist rope.

Visitors have recorded their impressions in glowing words. In 1543, for example, one Jodocus Willichius, thought to be a disciple of Erasmus, described the mine as "an underground Labyrinth more remarkable than that of Daedalus in Crete, and where one truly must unravel the magic thread of Theseus in order to reemerge safely." And in 1647 Jean Le Laboureur, a French nobleman and courtier to King Louis XIV, said: "The salt mine of Wieliczka is as praiseworthy as the Pyramids of Egypt." Small wonder that in 1977 Kopalnia Soli Wieliczka, to use the proper Polish name, became one of the first eight sites around the globe to be placed on UNESCO's World Heritage List, which is under the authority of the UNESCO Convention on the Protection of World Cultural and National Heritage.

Such a distinction is unique for a salt mine, even allowing that salt was the "white gold" of the Middle Ages, a source of medieval rulers' riches, and a treasure over which they fought many bloody battles because it was then the primary means of preserving food. But Wieliczka, in operation since the 13th century and still producing 150,000 tons a year, is no ordinary salt mine.

The nine levels that now compose the system extend from the first, at about 210 feet below the surface, to the bottom one at 1,100 feet down; the mine burrows mazelike, with 125 miles of tunnels, galleries, pitheads, chambers and caverns, under the entire town of Wieliczka. Horizontal passageways are connected by 26 vertical shafts from the surface–six still operable today, five with

"Gas burners" (above, left) were heroic men who burned off deadly pockets of methane gas under the ceiling.

Modern-day miner (above) replaces salt crystal that, in the legend, was said to contain Princess Kinga's ring.

mechanical hoists–and another 170 shafts that connect the headings and chambers internally, linking up the different levels. The tour that is given to visitors is only a small part of the vast complex on the first three levels, but even that route requires about three to four hours to complete.

The origins of this amazing world go back approximately 15 million years to the Miocene Epoch. "In those times this part of Poland, like much of southern and central Europe, was covered by a warm, Mediterranean-type sea," explained Prof. Andrzej Slaczka. Head of the Institute of Geological Sciences at Krakow's Jagiellonian University, and the leading expert on Wieliczka, he was kind enough to compress some 12 million years of geologic activity into a sound-bite: "Then there was a period of hot, dry climate which partly caused the sea to evaporate, leaving deposits of sand and salt in the process. This was accompanied by the rise of the Carpathians, which caused numerous inversions and also much slumping and folding of the terrain. During subsequent periods in the later Miocene and early Pliocene epochs we had very strong tectonic movements, including earthquakes. Thus, the initial salt deposits from that Miocene sea were subjected to big translocations and other disturbing factors that left the deposits at Wieliczka very complex and intricate." The deposits that he was referring to consist of huge layers and blocks of crystallized rock salt that are mixed with sand and marl. These are surrounded by impermeable clays and mudstones, which protected the broken salt deposits from erosion.

At the saltworks museum, a collection of cone-shaped clay cups and bowls dating from around 3500 B.C. is the earliest evidence of salt exploitation at Wieliczka. They were used for boiling brine until it evaporated, leaving a residue of pure salt. Called *briquetage*, the method was used by Neolithic settlers of southern Poland, who had found springs and pools of brine in the area. After those surface sources of salt water disappeared or were used up, probably around 1000 B.C., Bronze Age inhabitants began sinking wells to get at brine belowground.

This rudimentary form of extraction continued well into the 13th century; by that time salt production had become quite an industry. Even before the formal founding of the Polish state–by Duke Mieszko I of the Piast dynasty in 966–Wieliczka was renowned as a salt-producing center. The bustling community was then called Wielka Sol, meaning "Great Salt," which evolved into the name Wieliczka.

With the discovery of rock salt in 1288, systematic mining began. A charming legend surrounds this event. The story goes that Princess Kinga, daughter of Hungarian King Bela IV, was betrothed in 1239 to Boleslaw the Bashful, prince of the Krakow-Sandomierz province.

Former Newsweek *correspondent John Dornberg, who is a resident of Munich, wrote most recently about the Dorotheum in Vienna (December 1990).*

Though Hungary had rich resources of salt, Poland had almost none. So Kinga begged her father to give her one of Hungary's salt mines as part of her dowry. He granted her wish. Just before she left Hungary for Poland with her entourage of noblemen and knights, inspired by a vision she dropped her engagement ring into the shaft of the mine her father had given to her. Upon arriving in Krakow she again had a vision, and she ordered a shaft to be sunk near Wieliczka. The first lump of salt that was brought up contained her ring. There may be a historical basis for the Kinga legend, says Jozef Piotrowicz, chief historian of the saltworks museum. She may even have brought or recruited Hungarian miners, who used new methods, to this part of Poland.

Immortalized in a line of bath salts

Fact or not, Princess Kinga seems to be everywhere–belowground and above–in Wieliczka. Not only is the largest and most ornate subterranean chapel dedicated to her (right), but one of the main shafts and a park surrounding another are named for her. The line of scented bath salts produced by the mine's factory is called "Kinga." She is the patron of Polish salt miners, and her name day–July 24–is celebrated with a high mass in her glorious chapel.

On the first level of the mine, in the grottolike Janowice Chamber, is a sculptural tableau of the pivotal moment in the Kinga legend. The figures were carved out of rock salt in 1967 by Mieczyslaw Kluzek, a miner whose work appears in several other chambers. Blessed Kinga, in her royal robes and crown, is surrounded by a retinue of Polish and Hungarian knights in armor and three mine workers wearing the protective hoods and shrouds used in the Middle Ages. One miner kneels at the edge of a small shaft he has just dug. His left hand grasps his pickax; in the palm of his right, he offers to the princess the chunk of salt with the ring that had magically traveled underground with her all the way from Hungary.

Judging by the vastness of the oldest still-active borehole, Wieliczka became a bonanza soon after mining operations began. The Regis Shaft was sunk in the early 14th century on orders of King Casimir the Great, who is credited with turning Wieliczka into a kind of medieval Klondike. Like all subsequent Polish kings and other rulers–including the Austrian Habsburg emperors who controlled this area from 1772 to 1918, the Nazi occupiers during World War II, the postwar Communist regime and today's government under President Lech Walesa–Casimir as sovereign had title to all underground resources. In effect, he owned the mine. To this day the table salt produced by Kopalnia Soli Wieliczka bears the label Krolewska Sol–"Royal Salt." During Casimir the Great's long reign–from 1333 to 1370–earnings on Wieliczka's salt provided one-third of the royal treasury's annual revenues; under subsequent kings they averaged one-fourth.

Salt-crystal chandeliers illuminate a mass in the Kinga Chapel, largest of the mine's three main chapels.

Casimir surrounded the bustling town with thick defensive walls and built a fortified castle to protect it. The castle now houses the administration of the saltworks museum as well as its library, documents collection, storage area and an exhibit space. Casimir also codified the rights of miners and established a management system that endured for centuries until the mine became a state enterprise under the Communists after World War II. His Krakow Salt-Works Statute of 1368 stipulated that no prisoners, serfs or convicted criminals could work in the mine, only free men, who were to be paid a just wage for their labor. Moreover, he introduced a system of "administrators" who bought or leased exploitation, operation and management rights from the crown, paying a flat fee or share of the profits to the king and–dur-

All of the sculptures and reliefs, including the altar itself, with Blessed Kinga at its center, are salt.

ing the Austrian annexation–to the Habsburg emperors.

"These administrators were usually men of great wealth–merchants, bankers, aristocrats," Jerzy Grzesiowski, vice-director of the museum, explained to me as he showed me through the castle. "The contracts were normally for four years, and during that time the administrator and his family lived right here in the castle. It also housed the mine managers, with offices for the various supervisors, directors, masters, foremen, engineers and geologists."

The mine's long history is one of human ingenuity, constant struggle against the forces of nature, and tragedy. Until recently those millions of tons of salt extracted over the centuries were all chipped, chopped, hacked and cut by hand out of huge isolated deposits of rock salt, as hard as gypsum and encased in sandstone, marl and clay. Exploiting these deposits, many of them measuring 15,000 to 30,000 cubic yards, left enormous and magnificent caverns and chambers. To stabilize and prevent the chambers–as well as the mine and the entire town–from collapsing, they had to be shored up and vaulted with pillars of salt and countless forests of timber. It was excruciating and dangerous labor.

So was transporting workers, horses and equipment belowground and heaving gargantuan chunks of solid salt and barrels of crushed salt along the gloomy tunnels and up to the surface. The miners designed and constructed a bewildering array of intricate wooden devices and machines–sleds, carts, trolleys, windlasses, gear winches, hoists, braking mechanisms, pumps and salt crushers—all either operated by hand or driven by horses, which were kept in subterranean stables their entire lives. Sitting in slings attached to long, thick ropes of linden bark or hemp, miners descended and ascended the shafts by human-powered pulley. Only in 1890 did mechanized mining begin; the first pneumatic drills and jackhammers for extracting salt were introduced in 1914. The old rough-hewn yet highly complicated tools, some of them made as far back as the 16th century, are on exhibit in the underground museum.

Accidents claimed 80 to 90 men a year

Subterranean hazards were numerous: cave-ins, floods, and fires caused by concentrations of methane gas that turned the timber-shored chambers into infernos. "During the Middle Ages the mine's work staff averaged 800 to 900 men," Grzesiowski told me. "Old documents show that 80 to 90 of them were killed in accidents each year."

One of the worst fires, in 1510, killed more than 100 workers, including the mine's director and his deputy. A hauntingly dramatic painting of the event by 19th-century Polish artist Jan Matejko hangs in the underground museum. It depicts the two executives clinging, doomed, to a flaming hoist rope (p. 98). Such fires would have been far more frequent if not for the heroic "gas burners." They are depicted in a spine-tingling scene in the Komora Spalone–the Burned Chamber–by Mieczyslaw Kluzek, the miner-sculptor who carved the Kinga tableau. Gas burners were courageous miners who risked their lives, and often lost them, by seeking out and burning off the deadly pockets of methane gas that collected under the cavern ceilings. Before the introduction of ventilation systems and electric lamps, such pockets of gas were a constant threat. Called "penitents" because of the way they crawled and kneeled on cavern floors, the gas burners wore hooded cloaks to shield themselves, and they carried small torches of hemp or bark attached to long poles, which they held against the ceiling in order to trigger small, controlled explosions of methane.

Floods have also taken their toll; a major flood has occurred, on average, about every hundred years. But

Members of the Wieliczka Salt Mine Brass Band kick back in town after giving a concert; the group's busy schedule includes masses, weddings, band festivals.

none was as bad as the flood in 1992 when, between April and October, up to 5,000 gallons of water per minute gushed into the Mina Gallery on the fourth level, 560 feet below the surface, causing major cave-ins. A year later, when I visited, miners and engineers were still working around the clock to control the leak.

The constant threat of flooding keeps the mine in a kind of Catch-22 situation. Although still a functioning enterprise–employing 1,300 workers, it produces 150,000 tons of salt a year–the mine loses money. "We operate in very red ink," one of the directors told me. "That's unavoidable, given the nature and purpose of this operation. Producing and selling salt is no longer our main objective; but we have to in order to preserve the mine for future generations." The greatest problem is the influx of water, like the 1992 flood. If water were not regularly extracted as part of the day-to-day mining operation, it would erode the salt pillars and other salt reinforcements that support the chambers and tunnels. Eventually, the whole town would collapse.

Despite its dangers, the mine opened to tourists soon after the first shaft was sunk; Casimir the Great personally escorted the more important among them. Holy Roman Emperor Sigismund, King Eric VII of Denmark and other, lesser royals visited it while traveling to Krakow for a coronation ceremony in 1424. Organized tourism began in 1772, which is also when a "golden book" of VIP signatures and comments was started; it now runs to many volumes.

Eventually, tours evolved into elaborate excursions. Ornate horse-drawn rail carriages with gold-leaf decoration and lushly upholstered red-velvet seats took the royals and aristocrats around the maze of tunnels. Salt sculpting proliferated; there were subterranean feasts. American writer John Ross Browne described a visit in 1866 that included a boat trip on an underground lake and a serenade by the salt mine's own band.

It's not quite like that anymore, given the demands of a half-million visitors each year. Alas, there have been no boat trips on the brine lake since 1915, when a barge with merrymaking Austrian soldiers capsized, killing seven of them. But the plush, gilded rail carriages can be seen in the museum. And the 42-member Wieliczka Salt Mine Brass Band, founded in 1830, is still going strong, giving 30 concerts annually in addition to performing at masses, weddings, funerals and international band festivals. I learned this from the manager of the band, Stanislaw Fiolek, an electrician at the mine who also plays the tuba. "We are the oldest continuously existing brass ensemble in the world," he told me with obvious pride. "We play everything from marches to symphonies, from requiems to polkas, from Christmas carols to Dixieland jazz, and we would now like to get scores of American brass music from the U.S. Navy band."

The very existence of a salt mine brass band–not something one might expect–characterizes the continually surprising nature of the entire place. This extends even to the appearance of the salt itself. The first time I entered a damp, chilly tunnel, I noticed that the rough, jagged walls were dark–brownish gray to almost black–instead of white like salt in a shaker. But scratching off a few grains and tasting them proved that it was salt; the appearance, I was told, is typical of rock salt embedded in petrified marl and clay. When illuminated by a flashlight, it gleamed translucent and marblelike.

A surprise of a different kind is the Star of David, a hauntingly beautiful monument over the entrance to the vast Staszic Chamber. It serves as a reminder of the

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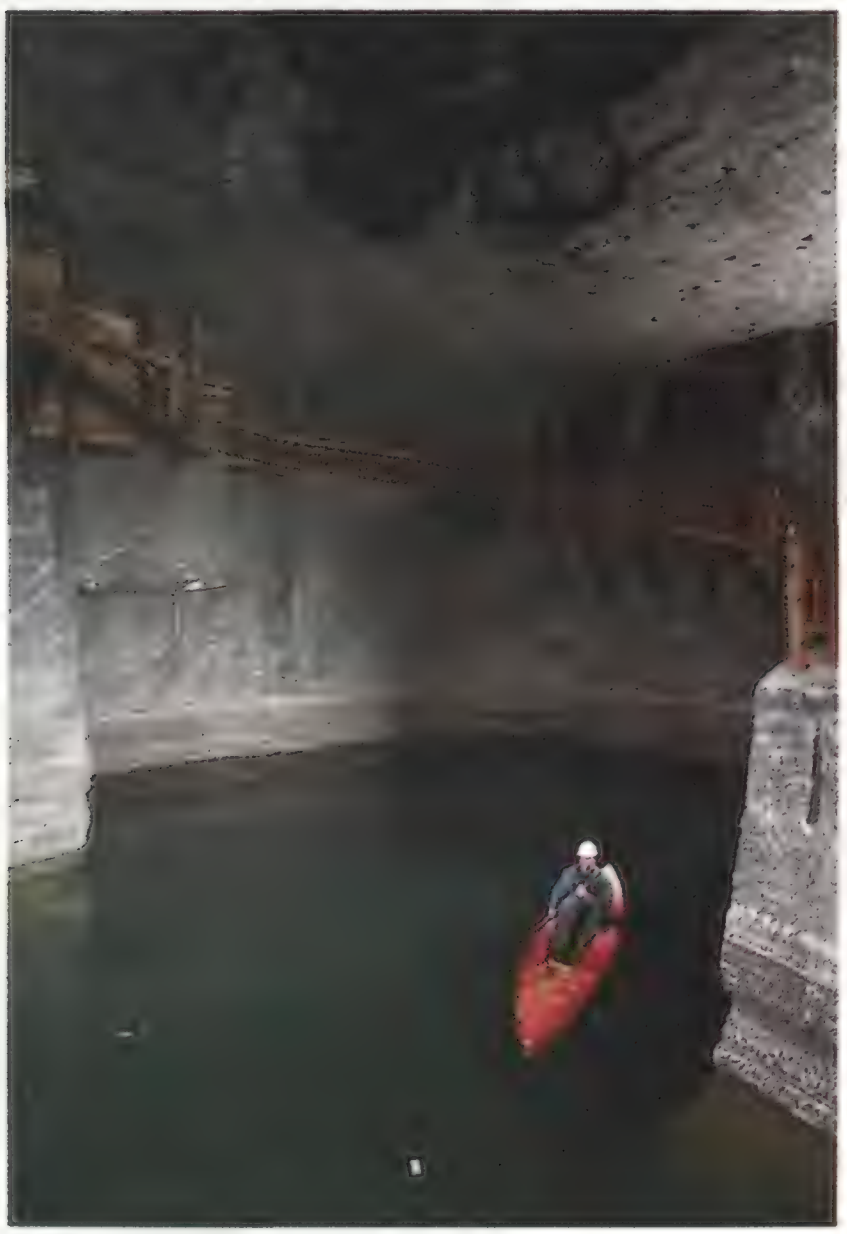

Mine worker collects currency thrown into one of the briny lakes by some of the 500,000 annual visitors.

horrors of World War II and the Holocaust. Here 2,000 Jewish prisoners were forced to work in an underground aircraft-components plant that the Germans started setting up in the spring of 1944. The facility was still not finished in the fall, when the threat of the advancing Soviet Army forced the Germans to close it down. But the 2,000 slave workers had already been put on a death march to concentration camps in Austria and Czechoslovakia. Two teenage youths managed to evade the march by hiding in an abandoned heading, where they were found by miners.

Many of the caverns exhibit truly weird natural and man-made phenomena. In the Pieskowa Skala Chamber, the salt deposits contained so much sand from the long-ago Miocene sea that what remained after extraction now resembles a subterranean desert. Others look like underground moonscapes. Though the brine lakes are man-made, they are eerie nonetheless.

Some chambers are masterworks of mining carpentry, with walls and ceilings–in one case 115 feet high–reinforced by thousands of spruce and pine logs. One of the largest–177 feet long, 56 feet wide and nearly 30 feet high–is the Warsaw Chamber, an underground auditorium and multifunction hall, complete with restaurants. It is used for basketball and volleyball games, indoor tennis matches, opera and theater productions, and the annual Miners Day banquet and ball, a shindig that usually lasts until dawn.

A cathedral–hundreds of feet belowground

But the most spectacular sight of all is the Blessed Kinga Chapel, consecrated in 1896. To call it a "chapel" is the ultimate understatement. It is so vast–180 feet long, nearly 60 feet wide, up to 40 feet high–and so ornate that it has the feel of a cathedral. Hundreds of worshipers attend the high masses celebrated here on Blessed Kinga Day, Christmas Eve and other holidays. The splendor is breathtaking: elaborately carved altars, shrines, crucifixes, bas-reliefs, vestries, presbytery, side chapels, rood screen, and gallery for the choir and miners' band. Light from the six enormous salt-crystal chandeliers warms the solid rock-salt floor, which has been carved to give the illusion of stone tiling.

By Wieliczka standards, the Kinga Chapel is relatively new; the chamber is what remained after final exploitation of an enormous block of salt in 1880. The work to turn it into a chapel started in 1895 when Jozef Markowski began carving the neo-Baroque main altar (another of his salt altars was exhibited at the 1900 world's fair in Paris). In 1920, the year that he died, his brother Tomasz joined the project, sculpting various bas-reliefs and statues until his own death in 1927. Then Antoni Wyrodek continued their work. The only miner who had some formal art training, Wyrodek took courses

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at the Krakow Academy, which were paid for by the mine management. His finest works are five bas-reliefs of biblical scenes set in the walls of the nave.

Just when I thought I had seen everything at this amazing place–what could surprise me after the underground lakes, the band, the magnificent Blessed Kinga Chapel?–there was one final stop: the sanatorium. Dr. Maria Nawiesniak, one of the four staff physicians, told me about its unique history as we descended on a closet-size miner's hoist.

"The origins go back to the early 19th century, to Dr. Feliks Boczkowski, a pioneer in industrial medicine and miner's diseases," she explained. "He had observed that there were virtually no symptoms or cases of asthma, bronchitis and similar respiratory ailments among the Wieliczka miners, and conjectured that this might be due to the salt air they breathed." The underground clinic was founded in 1964 by Dr. Mieczyslaw Skulimowski, a specialist in allergenic respiratory diseases who had studied Boczkowski's work. It was the beginning of a method now called "subterraneo-therapy." Each patient spends 100 hours over a 24-day period in the underground wards, and they do this for five consecutive years. During their stay they inhale highly concentrated and humidified salt air, which is pumped in from other areas of the complex.

"Of course, we combine this therapy with other things, such as total rest in near darkness," Nawiesniak explained, ushering me into a ward. There, under the almost totally dimmed light of a salt-crystal chandelier, I gradually made out rows of wooden beds into which were tucked slumbering people, all neatly bundled in thick wool blankets.

Now I'd seen everything.

Deep below the town of Wieliczka, patients in the mine's sanatorium rest under the watchful eye of nurse Paulina Rozwadowska. The salty air here–446 feet straight down–helps in the cure of respiratory illnesses.

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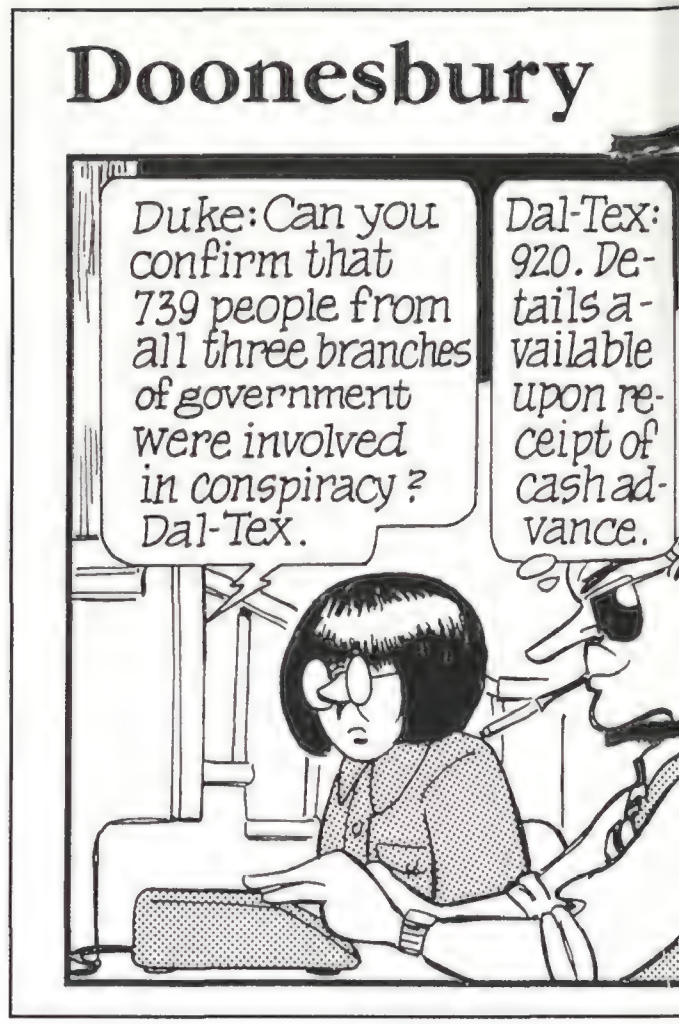
By Robert Wernick

Don't look now–but all those plotters might be hiding under your bed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Throughout time, imagined conspiracies have fueled our penchant for paranoia, and real ones have actually changed the course of history

"Surely you're not damnfool enough," he said, fixing me with his glittering eyes, "to believe the official story of a lone gunman. A lone dim-witted gunman who just happened to be posted near a place where the motorcade just happened to turn into a street which was not on the publicly announced route. A gunman toting a gun that had been given to him only a few weeks before and that he did not know how to use, but who put a shot into that moving car that hit the body at just the point where it was bound to be fatal. I tell you, my friend, the great events of this world are not unleashed by lone, loony gunmen taking potshots on city streets. This had to be a highly sophisticated military operation, involving professional sharpshooters, in just the place and at just the time when it would result in war. It had to be organized in the very highest circles of government by people who knew every string to pull. Look how well their plan was carried out, look how it had just the consequences they wanted, and then tell me it was all the work of a high school dropout with bad lungs."

You will have guessed by now that he was talking to me about the assassination of the Archduke Franz Ferdinand in Sarajevo, the spark that blew up the world in 1914. We were in 1938 by this time, in Paris, where he was the correspondent of a great American newspaper, and he was explaining to me how a new war was about to begin under the sponsorship of the same secret planners of World War I.

I had been taught in school that World War I was started by Gavrilo Princip, one of a group of half a dozen hotheaded young men, mainly Serbs, who had gone to Sarajevo expressly to murder the archduke when he made his untimely visit there. I had heard that there was much dispute among historians as to whether these boys were acting on their harebrained own, or had been put up to it by extremist elements in the Serbian government, possibly in concert with extremist elements in the Russian government, or had their way made easy by extremist elements in the Austro-Hungarian government who knew they were coming but did nothing to stop them.

My friend would have none of all this pettiness. "This was a big operation," he said. "There was no one in Belgrade or Vienna with enough intelligence to arrange something on this scale. They had to get the archduke to Sarajevo, which was a provocation to the Serbs, and on St. Vitus Day at that, a great Serbian national holiday. They had to arrange that there would be a pitiful 120 policemen to guard the whole route of the motorcade. They had to know that customs officers would not see the guns slipping over the river into Bosnia. They had to make sure that the president of France was at sea so he could not interfere. And above all, they had to make sure that the killing was done not on any old summer day, but a summer day in 1914, which historians now know was the only time a war could start with the armed forces of the powers evenly matched, so that it would have to be a long war. And a long war meant astronomical profits for the international bankers, controlled by the Elders of Zion. Who else would have known that the war had to be long? Who else would have known

BY GARRY TRUDEAU
SIR! THIS IS A NEW LOW— EVEN FOR YOU!
HEY, C'MON, IF I DON'T MAKE UP THIS STUFF, THEY WILL...
IF OSWALD ACTED ALONE, THEIR LIVES HAVE BEEN A FARCE — AN UTTER WASTE! THE TRUTH WOULD DESTROY THESE PEOPLE...
Duke: Was Lady Bird in on it?
Big time.
I DO THIS OUT OF COMPASSION, HONEY.
TAP! TAP!
12-9

Cartoonist Garry Trudeau spoofed Conspiracy Theorists in a recent series of *Doonesbury* strips. Here, Duke uses a computer network to fleece assassination buffs. In 1970s, strip tracked real cover-up called Watergate.

that the archduke would be wearing bulletproof clothes and the only sure way to kill him was to put a bullet straight through his jugular vein, which they did?"

I was a little overwhelmed by this marshaling of putative facts, and only suggested very tentatively that I assumed he had documentary proof of all that he was saying.

"Proof!" he shouted, making the saucers bounce on the table on the terrace of Brasserie Lipp. "You don't suppose that men who were going to change the course of world history were going to leave a paper trail of their plans and operations, do you? The proof is that Franz Ferdinand was shot in Sarajevo on St. Vitus Day, and that within a matter of weeks the world was at war. What more do you want?"

This was my own personal introduction to the lushly alluring world of Conspiracy Theory.

It has been with us for a long time, for it follows naturally on conspiracy itself, which is a universal human activity spread through all the time and space available to mankind. It is perhaps one of the activities that helps define the state of being human. Certainly lions and monkeys do not know how to form a conspiracy, in the legal sense of "an agreement, manifesting itself in words or deeds, by which two or more persons confederate to do an unlawful act, or to use unlawful means to do an act which is lawful."

Uncounted conspiracies are going on all around you as you read these words, conspiracies to kill rulers and subvert states, to mount hostile takeovers of Fortune 500 companies, to rob banks, smuggle drugs, destroy reputations, get unqualified pals appointed to government jobs, commit adultery, shoot deer out of season. Or bring down a nominee for Secretary of Defense, or try to cut short a young figure skater's career.

If the chronology of the third chapter of Genesis is correct, conspiracy was the first spontaneous activity in which any creatures participated after the Creation, antedating even sex, which does not make an appearance till Chapter IV. The Serpent, as you remember, was the subtlest beast of the field, who spoke good Hebrew and was able to conspire successfully with Eve to lure Adam into fatal trouble.

The story in Genesis is both brief and straightforward, but strategically placed as it is, at the very dawn of history, it must obviously have depths of meaning, and Jewish rabbis and Christian theologians have never ceased trying to plumb them. It was decided at an early date that the Serpent must be the Devil in disguise.

But the official explanation, orthodox in both Catholic and Protestant churches for centuries, was formulated by Saint Augustine in the fifth century A.D. It states that the whole episode in Eden was the result of a divine plan engineered to test humanity's fortitude and faithfulness. We failed, obviously, thereby incurring a permanent human bondage to sin. The schemer in the story, though, is the Devil, whose intrigues bring everyone to ruin.

This may be described as the first Conspiracy Theory, at least the first to be officially recorded. Of course, since Augustine did not have the modern apparatus of stenographic transcripts and tape recordings of the talk be-

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Plotters who murdered the Archduke Ferdinand ignited World War I.

tween Eve and the snake, he had nothing that would count as evidence in a modern court of law. What he had was religious insight.

It is this that distinguishes a Conspiracy Theory from theorizing about real-life conspiracies. The latter, as everyone who has ever sat in a jury box has learned, is something we all have to do if we want to explain any particular event in the past. It is a terribly hard thing to do conscientiously because, even in the most simple cases, there are so many crosscurrents, so many unpredictable elements, that the more you look at it, the more impossible it seems to find out what really, truly happened.

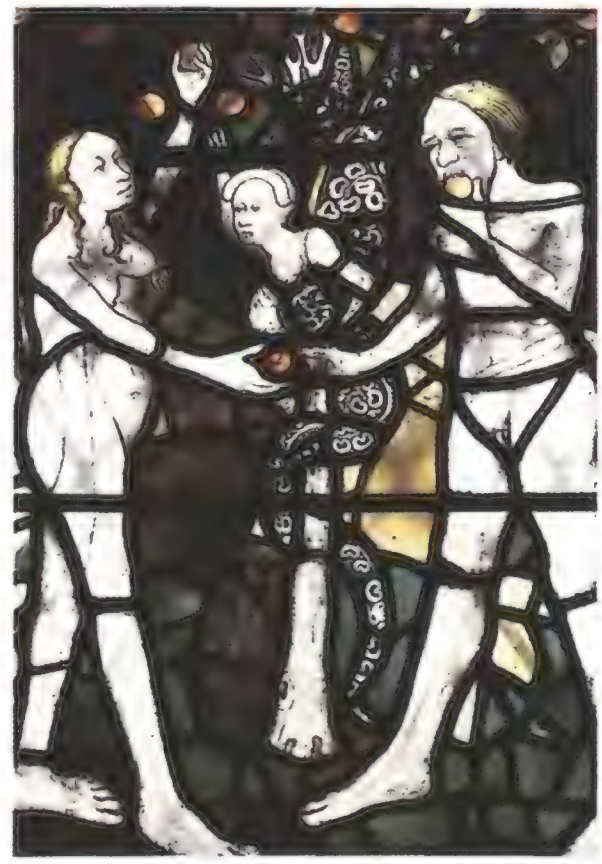
For a complex event like the outbreak of World War I, the number of forces pulling in different directions in all the major countries of Europe is so enormous that no historian can ever hope to wholly straighten them out. This is a disturbing conclusion, for all of us like simple explanations.

Conspiracy Theory offers us all the simplicity we want. The Theorist can find his way through the bewildering thicket of fact because he knows where he is going. As the man says in the Oliver Stone movie *JFK*, discussing the assassination in Dallas: never mind the What and How, that is mere window dressing; what you must concentrate on is the Why.

If you know Why the archduke was murdered in Sarajevo–to further the plans of the Elders of Zion–or Why the French Revolution broke out on July 14, 1789–to further the plans of the hapless Duke of Orléans (SMITHSONIAN, July 1989)–you can always discern, within any historic event, a pattern to support you.

To take a fairly simple example: in June 1688, Mary of Modena, the second wife of King James II, gave birth to a baby boy in London. Good Protestants immediately knew the reason Why. It was to ensure that the rule of England would pass from wicked King James to an endless line of Papists instead of to Princess Mary, his Protestant daughter by a previous marriage.

It followed that Mary of Modena had never been pregnant at all. At the time of her alleged lying-in, rumor had it, a person who did not look like a regular palace servant brought a large warming pan into the royal bedchamber. It was obvious that a baby boy, plucked



Sneaky Serpent, tempter of Adam and Eve, may be the archetypal conspirator.

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William of Orange and Mary won English throne after plotters cleared the way.

off the streets of London, was in that pan and was now, by the Devil's grace, heir to the kingdom.

But how about all the eyewitnesses? A royal birth in those days was a public event, with scores of officials, noblewomen, doctors and servants milling through the royal apartments, and a number of distinguished names were signed to a document attesting to the birth. A Conspiracy Theorist is never troubled by such documents. All the people allowed to be present at the "birth" were Roman Catholics, or married to Roman Catholics, or had something to gain from Roman Catholics. In short they were all perjurers, suborned by the Society of Jesus–the fearsome Jesuits of whom the historian Macaulay would later write that the "most atrocious plots recorded in history" could be attributed to their ceaseless secret conniving.

The Jesuits are only one in a long roll call of veiled and vicious organizations that have been controlling the levers of destiny in Conspiracy Theory

Frequent contributor Robert Wernick wrote recently on Thomas Jefferson at Monticello and on Johnny Hopper.

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through the ages. They were preceded by the Knights Templar and were to be followed by the Freemasons, the British intelligence service, the Elders of Zion, the Mafia, the Comintern, the Trilateral Commission, the CIA, the Masters of the Lost Continent of Mu (the mythical Pacific redoubt of some proto-Polynesian peoples).

Some of these have more relation to real life than others, and have all kinds of big and little real-life conspiracies to their credit. They form a most diverse group, but in the lurid dreamworld of Conspiracy Theory they are all exactly alike. They are huge, they are faceless, malevolent and ubiquitous, and above all they are supernaturally efficient.

The family resemblance can be very strong. Umberto Eco, in his novel of Conspiracy Theorists in full cry, *Foucault's Pendulum*, notes that a program for world domination, as outlined in a bizarre tract called the *Protocols of the Elders of Zion*–an anti-Semitic document assumed by scholars to have been fabricated in Europe around the 1860s–can be found in a novel written by Eugène Sue in Paris some 20 years earlier. In Sue's version, the world-domination plot was set in place by the Jesuits.

In contrast, let us turn for a moment to look at a real-life conspiracy, perhaps the most successful conspiracy

Karl Goerdeler, one of those who tried to kill Hitler, nearly did alter history.

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that ever was. In the same year, 1688, that saw the launching of the Mary of Modena Warming Pan Theory, seven of the most powerful men in England–six great noblemen and the Bishop of London–smuggled a letter across the sea to Holland, asking Prince William of Orange, husband of James II's daughter Mary, to invade England and promising to put him on the throne if he did.

The prince was willing, collected a great army, set sail and landed in Devonshire with no opposition. Everything went well for the conspirators. People flocked to William's standard.

James fled to France, and the Prince of Orange became King William III of England without a struggle. It worked so well that no one ever thinks of it as a conspiracy. It is known in the history books as the Glorious Revolution, and is properly regarded as one of the main foundations of the liberties enjoyed throughout most of the world.

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Theorists, it was strictly a second-rate operation: seven plotters or so, and very little cloak-and-dagger business at that. Confirmed Conspiracy Theorists traffic only in plots involving casts of tens of thousands of people; they furthermore expect no one to talk and no one else to notice anything amiss. (That silence of the masses is a hallmark of Conspiracy Theory.) In this murky, romantic-demonic world, they would have us believe, vast multitudes take solemn oaths not to reveal the Secret, and then keep their oaths through thick and thin.

Conspiracy Theorists point out disparagingly that conspirators who talk tend to be the second-raters. In fact, conspirators often can't seem to shut up. Conspirators who fail–like the harem ladies who plotted to kill Pharaoh Ramses III around 1100 B.C., or the officers who plotted to kill Hitler in A.D. 1944–spill all the beans under the pressure of police interrogation and the torture chamber.

Conspirators who succeed cannot help boasting about it. When Brutus and his friends successfully conspired to murder Julius Caesar, they went right to the Capitol in their blood-stained togas to assure the public they had dispatched a tyrant. When Kim Philby successfully conspired to infiltrate British Intelligence with Soviet agents, when Kermit Roosevelt successfully conspired to overthrow the government of Mohammed Mossadegh in Iran, they wrote books about it, describing their dark, devious maneuvers in great detail.

Philby's revelations, published in 1965, two years after the master spy had defected and was ensconced comfortably in Moscow, sent shock waves through the ranks of MI-5. With his own patrician eloquence, Philby chronicled, in *My Silent War*, the years of brilliantly orchestrated espionage. His ascension to the upper reaches of the British intelligence service went flawlessly from the start: "The ease of entry," he would write, "surprised me. . . . The only inquiry made into my past

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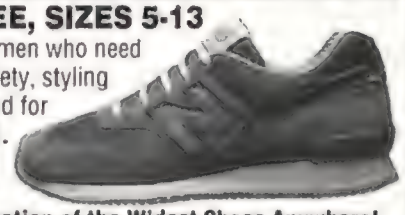

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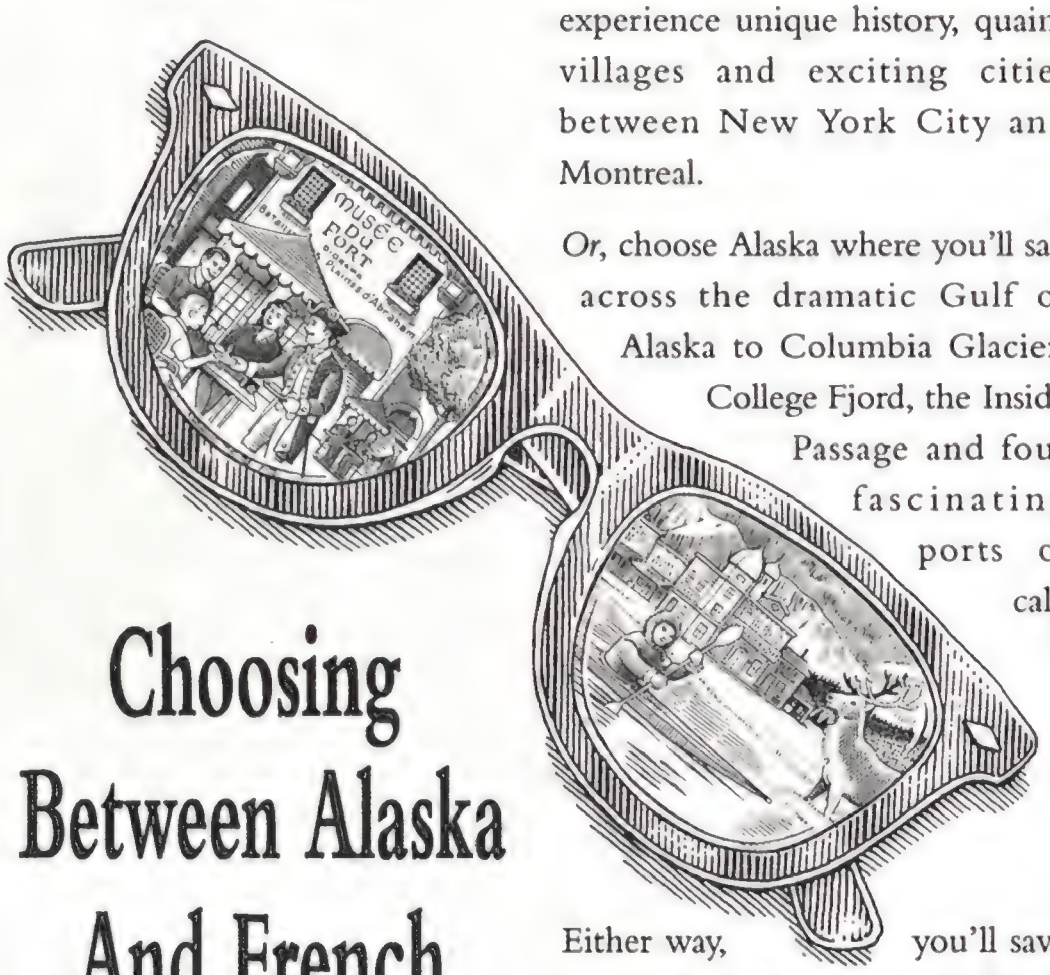

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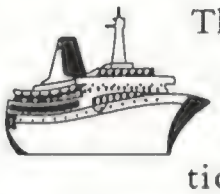

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Dashing master spy Kim Philby eluded detection till he defected to Moscow.

was routine." From that moment, in the 1940s, Philby went on to direct a stunningly successful network that included the arch coconspirators Burgess and Maclean. Philby spared no one in the telling. His account of the British secret service, as novelist Graham Greene would write in his introduction to Philby's book, was "devastatingly true" and "far more gripping than any novel of espionage."

Even when plot leaders can be counted on to keep their mouths shut, no real-life conspirator can ensure complete reliability on the part of all the underlings and hangers-on who inevitably get involved in any actual conspiracy.

Some readers of this magazine may know from experience that when they embark on the simplest and perhaps commonest of all real-life conspiracies–to engage in a bit of hanky-panky–they may start with the idea of a private affair involving only two peo-

ple, but they soon find themselves surrounded by an army of more or less unwitting confederates or witnesses–hotel clerks, taxi drivers, waiters, inquisitive neighbors, et cetera.

Expand the playing field a little, and the number of potential blabbers increases exponentially. Say, for example, that I were to float a Theory that the plays ascribed to Tennessee Williams were really written by Harry Truman. Skeptics would be quick to point out that, however intriguing the idea might be, and however much light it might cast on the American theater and American foreign policy, the sheer mechanics of the job would make it unthinkable that no one before me could have stumbled on the truth.

But viewed in the light of Conspiracy Theory, everything becomes simple: Mr. Truman drops by Mr. Williams' hotel room periodically and drops over the transom a bulky bundle labeled *The Glass Menagerie, The Rose Tattoo* and so forth. In real life there would have to be a battalion of secretaries, stenographers, telephone operators and messengers involved in transmitting the texts and revisions from Washington to Broadway. Would no one have noticed during rehearsals of *A Streetcar Named Desire* that every time a change was proposed in the text or stage directions, Mr. Williams would excuse himself to make a long-distance telephone call? I frankly doubt if I would get very far with this Theory.

Yet when Ignatius Donnelly, the "Sage of Nininger City," Minnesota, announced in 1888 that he had deciphered the code, hidden within the text of "Shakespeare's" plays, that revealed the author to be Francis Bacon, Lord Chancellor of England, legions of people accepted the revelation with enthusiasm (Mark Twain among them).

People didn't seem to consider that Queen Elizabeth I's London was by our standards a very small place–about the size of today's Sheboygan, Wisconsin–where everybody knew everybody else, where everybody went to the same theaters, where there was absolutely no privacy in the modern sense for the great or small. London swarmed with gossipers, diarists, letter writers, disguised Jesuits, Spanish agents, French agents, police spies, all of them on the lookout for anything out of the ordinary. To assume that every single one of them took an oath of secrecy that they and their descendants kept for 300 years is to call for a suspension of disbelief of truly unusual proportions.

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It would be a mistake to think that such credulousness is limited to a handful of people with overactive imaginations. Everyone at some time or other, under the stress of overwhelming emotions, subscribes to some form of Conspiracy Theory. All wars start with Conspiracy Theories put out by the various governments, proving to the satisfaction of their citizens, at least for a while, that all the trouble was caused deliberately by the other side. Thomas Jefferson's Declaration of Independence could be construed as a Conspiracy Theory, placing the responsibility for everything that had gone wrong in the American Colonies on the machinations of poor, dim-witted George III. The French authorities, unable and unwilling to admit that their own appalling incompetence had allowed Hitler to demolish their armies in 1940, quickly concocted a handy Conspiracy Theory: a vast and preternaturally efficient network of pro-German Fifth Columnists–little or no trace of which has been found by subsequent research–had sabotaged any French resistance and opened all doors to the invaders.

Scholars, too, can start out simply researching a subject and end up entangled in their own Conspiracy Theories. Take the case of English historian Margaret Alice Murray when she began investigating the mass hysteria that had brought many "witches" to a violent end.

For almost three centuries, from the late 1400s on, the best minds of church and state were hard at work ferreting out evidence against men and women accused of making pacts with the Devil, holding diabolic councils and diabolic orgies, using charms and spells and wax figures to kill kings, shipwreck fleets, blast crops and subvert the whole order of Christendom. There are no definitive figures because so many records have been lost, but certainly tens of thousands of people confessed, usually after prolonged torture, to acts of witchcraft and were hanged or drowned or burned alive. During the

Theorists of a literary bent claim that Francis Bacon penned Shakespeare.

Spanish Inquisition alone, 100 persons might be burned as witches in a day.

By the end of the 17th century, belief in the existence of witchcraft was fading among educated people, and with it went a fading in belief in the existence of witches. The whole persecution mania that had swept the world for so many years came to be regarded as a colossal delusion, a mass dementia. By the 20th century, anyone who felt he was being unjustly accused of anything could win sympathy by saying he was the object of a witch-hunt.

Enter Murray, who went back over the records of all the hundreds of trials that have survived and studied them coolly, concentrating on what the accused were actually accused of. As she explained in her widely read book *The Witch-Cult in Western Europe*, published in 1921, she found many local variations from place to place, but the pattern of the confessions was generally the same. The witches met in groups, or covens, of 13; they danced, they stirred up magical potions in caldrons, they cast spells, they rode brooms, they invoked pagan deities. Every detail, or so Murray argued, could be found in such accounts as have survived of the old pagan religions that had existed in Europe for thousands of years before

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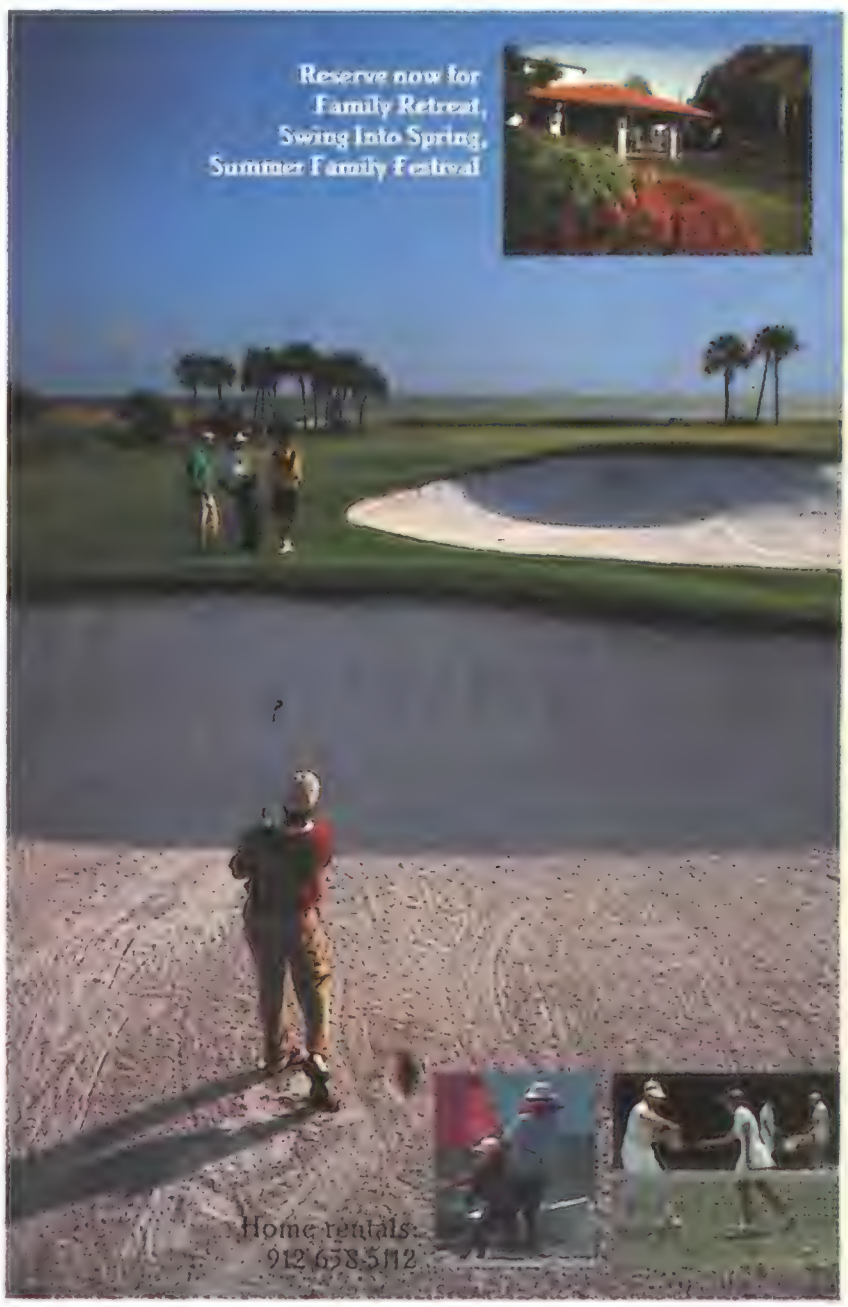

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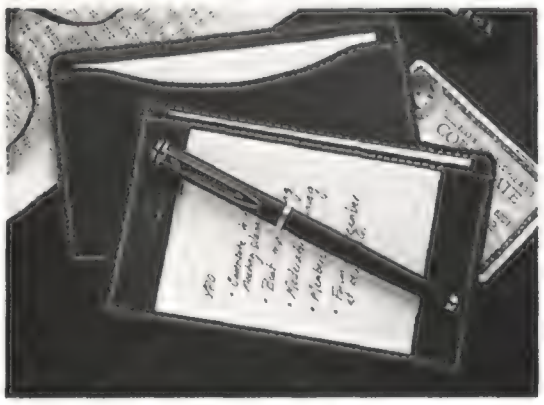

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the arrival of the Christian missionaries. Murray tried to make the case that the witches were perpetuating bits of the old beliefs and rituals that had managed to survive underground, especially in the more isolated reaches of the countryside.

Soon she had moved well beyond a study of witches and become a full-fledged paganist. The pre-Christian cults, she had convinced herself, were alive and well.

Murray went on to turn into a full-flowered Conspiracy Theorist. By the time she wrote her last book, *The Divine King in England*, she was ready to prove that the pagans had such control of the English and other governments, for several centuries, that they were able to perpetuate one of the central rites of ancient religions–to solemnly kill the king every seven years in order to ensure the fertility of the land. She was aware, of course, that very few kings came to violent ends in those centuries and their deaths were widely spaced in time. But she had an answer ready for that, straight out of the pagan ritual.

If the king so desired, he could appoint a surrogate who would take his place and go cheerfully to his death for the good of the people. Among the surrogates chosen, Murray names in France, Joan of Arc and Gilles de Rais–the original Bluebeard–and in England, Saint Thomas à Becket and two of Henry the VIII's wives, Ann Boleyn and Catherine Howard. Of course, the only reason we never learned about all this before is because the Church suppressed the truth.

Murray's case points up one of the fatal flaws of Conspiracy Theory: it makes conspirators so powerful that it leaves the bystander wondering why the results they achieve seem so curiously limited. If pagan holdovers could operate so easily up to the 17th century, why aren't they still around in shapes more formidable than the covens in our modern suburbs that meet to commune with the moon and grow herbs?

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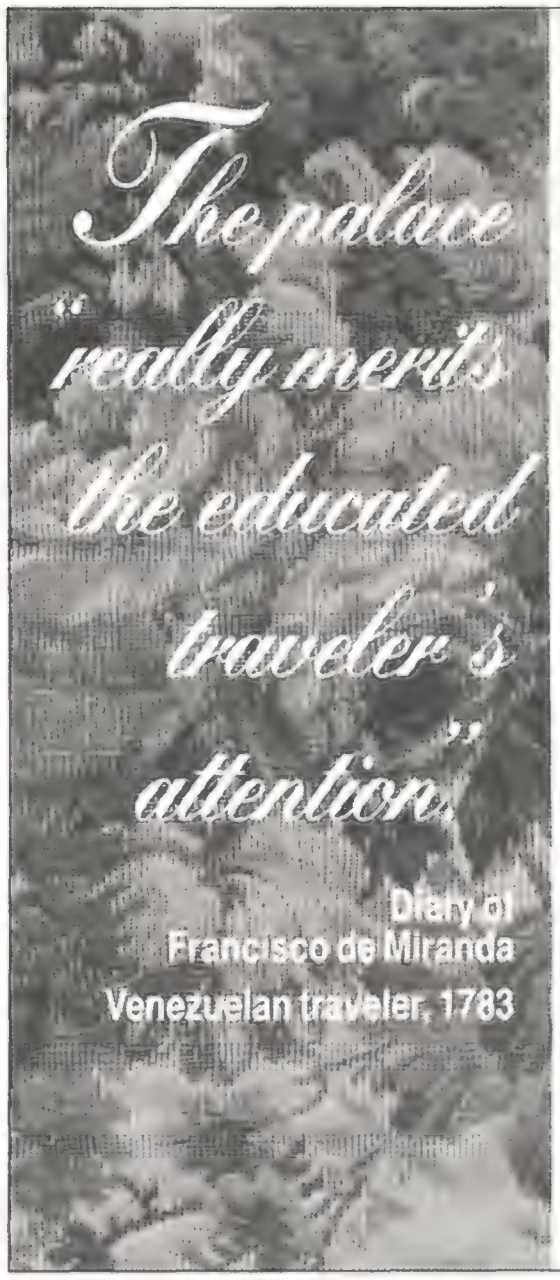
include wide swathes of the American government (according to Robert Welch, founder of the John Birch Society), and Einstein's Relativity Theory (according to Elizabeth Dilling's *The Red Network*), how did it happen that while Red armies could conquer a third of the planet by force of arms, Red conspirators could conquer nothing more than Angola? If the gun-happy Rambos of the CIA could murder a President of the United States in front of thousands of spectators and have all the blame put on a hapless lone gunman, how could they fail so signally to get rid of Fidel Castro, Ho Chi Minh and Oliver Stone, all of whom seem like much easier targets?

In a recent best-seller, *Holy Blood, Holy Grail*, three intrepid European researchers have torn the veil off a truly monstrous Conspiracy that has been going on for almost a thousand years now. This fearsome plot aims at nothing less than restoring the Merovingian dynasty, which ruled what is now France and western Germany from the fifth to ninth century A.D. This perhaps does not sound explosively controversial, as the book jacket indicates, until you are made to realize that the bloodline of the Merovingians (falsely stated by historians to have come to an end when Childeric III was

Conspiracists claim Merovingian king Childeric III descended from Jesus.



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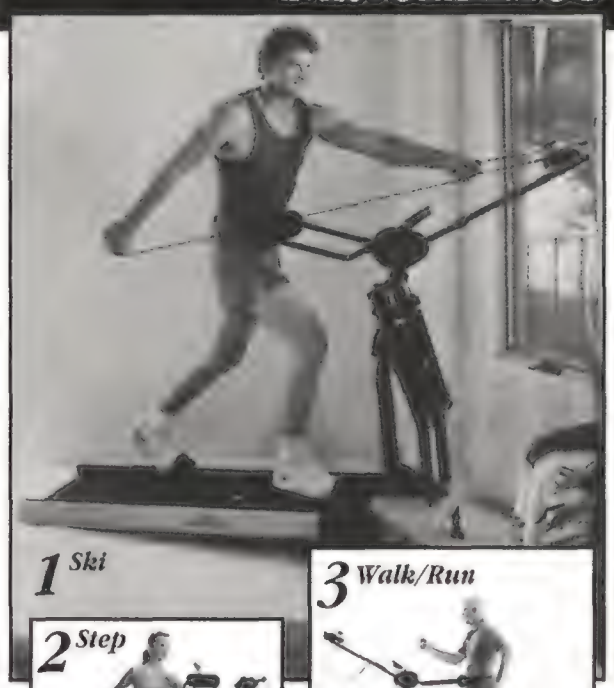

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deposed in A.D. 751) still runs through the veins of several prominent European families, like the Habsburgs and the descendants of the Stuart kings of England. And that the line goes back to the son born to Jesus Christ and Mary Magdalene, smuggled into Gaul by his mother a few years after the Crucifixion. And that among the people who have been involved in the attempt to restore the Merovingians to their old royal glory may be found Leonardo da Vinci, Sir Isaac Newton, Cardinal Richelieu, Victor Hugo, Claude Debussy, Jean Cocteau, Charles de Gaulle, Pope John XXIII, and scores of famous generals, statesmen, aristocrats, churchmen, alchemists and Rosicrucians.

But what does this immense mass of power and talent have to show for itself? After all those centuries of Conspiring, the Merovingians to have come closest to positions of power lately have been: Alain Poher, a self-effacing president of the French senate for a number of years; Henri de Montpézat, now Prince Henrik, consort of the Queen of Denmark; and Diana, Princess of Wales, who (if memory serves) claims descent from the Stuarts. There would seem to be a very serious gap between the richness of the resources devoted to the Conspiracy and the meagerness of the results achieved. Is there anyone in the world, outside of the book's authors–Messrs. Baigent, Leigh and Lincoln–who is afraid of the big bad Merovingians?

Perhaps there is an explanation that will confound the skeptics and leave the Conspiracy Theorists in possession of the field.

Suppose it can be shown that for each Conspiracy uncovered by the patient researches of a Theorist, there is almost always an equally vast, equally unscrupulous and equally powerful Counterconspiracy pushing in exactly the opposite direction. For every Merovingian plotter trying to engineer the return of a descendant of Clovis and Dagobert, there is a Carolingian plotter trying to do the same for a

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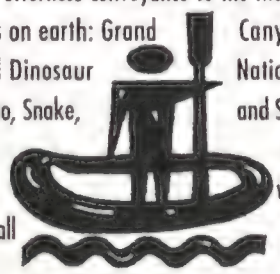

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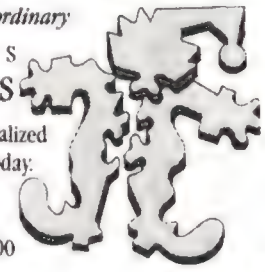

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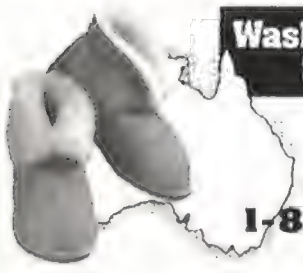

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descendant of Pepin and Charlemagne. The forces engaged in this struggle may be titanic, but they are also subterranean, and they tend to cancel each other out without disturbing the calm surface on which we live.

What would be the forces engaged in this struggle? The best place to look for them is in a field well trampled by Conspiracy Theorists, Presidential assassination. Leaving out Abraham Lincoln, who according to one theory conspired his own assassination, the United States has had, from James Garfield in 1881 to Ronald Reagan in 1981, six Presidents who have been shot at and killed, wounded or merely frightened by what official sources have unfailingly described as a lone, deranged assailant. Leaving out the laborious details, let us ask ourselves the vital question: Why?

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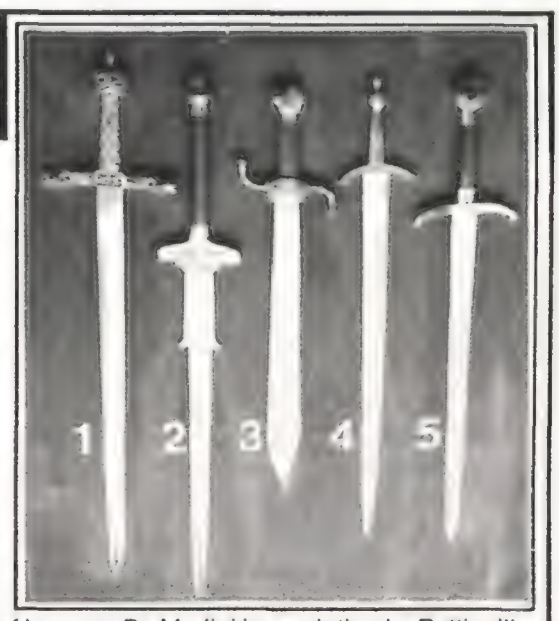

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stairs at the time and had no idea of what was going on. In America, a Vice President automatically succeeds a slain President.

If we look at the list of Vice Presidents who were waiting in line at the time of those assassinations and assassination attempts–Chester A. Arthur, Theodore Roosevelt, John N. Garner, Lyndon Johnson, Nelson Rockefeller, George Bush–a troubling pattern springs at once to mind. Three of these men–Arthur, Roosevelt and Rockefeller–were from New York, headquarters of the international banks. The other three–Garner, Johnson and Bush–were from Texas, headquarters of the oil interests. It would take a very naive person to believe that all this is coincidental.

It must be "obvious" that these assassinations were not isolated dramas. They are, as it were, the outcroppings of great tectonic movements that have been going on under our feet for a century without most of us having the slightest awareness of their existence. Two vast primal forces are locked in an unending struggle for the mastery of America, and are so evenly matched that they have had to accept an uneasy compromise, broken now and then by explosions of violence.

The bullets fired at the Presidents must be taken as warning signals that one side or the other is pushing too hard and had better pull back. Some of them, like the bullets in Dallas, are serious signals; others, like the shots fired at Gerald Ford by Squeakie Fromme, are mere tokens. In either case, they are all carefully choreographed–only the most naive could believe that Squeakie Fromme, trained by the ambitious if amateur Conspirator Charles Manson, did not in fact know how to shoot straight, as some have claimed.

I believe that my Theory fills a psychological as well as a logical gap. It takes away some of the uneasiness people feel at knowing they are being manipulated by unseen forces. Who would not rather be a foot soldier in an army commanded by Americans, even if they are rich, evil Americans, than be a mere pawn moved over a chessboard without recognizable lines or colors by the distant, inscrutable Masters of the Lost Continent of Mu?

Did John Wilkes Booth act alone? Historians have debated the question, but most agree that though the actor had collaborators, he killed Lincoln on his own.

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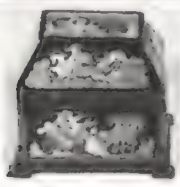

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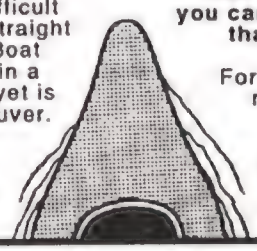

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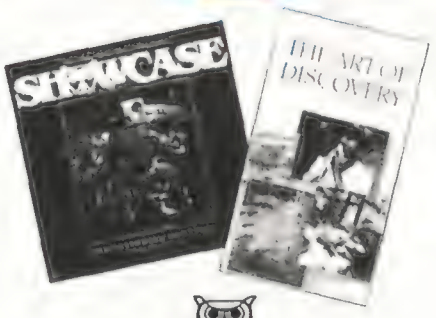

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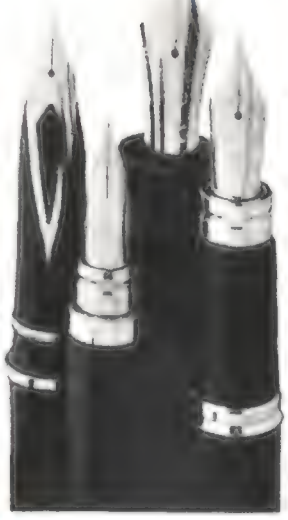

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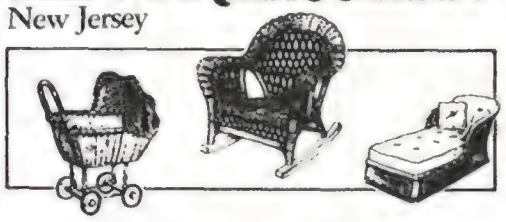

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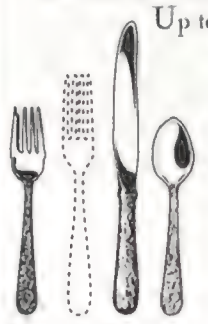

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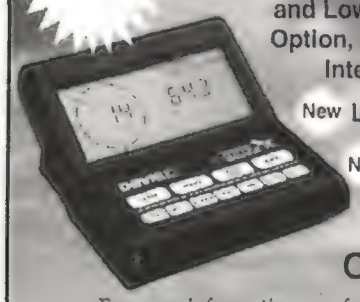

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Apache chiefs that David Roberts tells in *Once They Moved Like the Wind,* that of Cochise makes Hollywood oaters pale by comparison. Cochise was a disconcerting mixture of extreme brutality and great personal dignity. Although, as Roberts points out, U.S. soldiers were sometimes also guilty of shooting Indian civilians, Cochise and other Apaches killed men, women and children without discrimination, and practiced excruciating torture as a matter of course. Apaches were blamed for killing more than 400 Mexicans, white settlers and U.S. soldiers between 1862 and 1867 alone, and another 170 more before the death of Cochise in 1874. Yet, in a parley with American envoys, Cochise could disarmingly say, "When I was young I walked all over this country east and west, and saw no other people than the Apaches. After many summers I walked again and found another race of people had come to take it. How is it? Why is it that the Apaches wait to die?"

Roberts weaves his colorful account of the Apache wars mostly around familiar battles and treaties. Less conventionally, he works hard to balance Army versions of events with the views of Native Americans–no small task, since the Indians wrote no histories of their own and rarely left more than fragmentary and vague accounts. Although Roberts' sympathies seem to lie more with the fugitive Apaches than with their pursuers, he also conveys the frustrations of professional soldiers like Gen. George Crook, who had the daunting duty of chasing small bands of Indians who knew every inch of a forbidding territory larger than New England.

Roberts' narrative comes most vividly alive in its account of the climactic campaign of the Indian Wars, when for five tumultuous months in 1886 the erratic, incredibly tenacious warrior known as Geronimo carried out what "can fairly be regarded as the most remarkable campaign of guerrilla warfare ever witnessed on the North American continent." In those months his band of 37 Apaches raided with seeming impunity across parts of Arizona, New Mexico and Mexico, eluding no fewer than 5,000 American troops–one-quarter of the U.S. Army–plus hundreds of Indian scouts and 3,000 Mexican soldiers.

But what had begun at Apache Pass came to its inevitable conclusion on a September day in fittingly named Skeleton Canyon, where Gen. Nelson Miles accepted the surrender of Geronimo

and the last armed war party in American territory. Hungry and exhausted, the Apaches had agreed to accept internment in a faraway place called Florida. "The image of Florida in the fugitives' minds was a featureless dark hole, like the notion of slavery in the Mexican south," Roberts writes. "It was an unknowable void into which their people had vanished." As Army wagons carried Geronimo's people away to exile, cavalrymen who for years had chased the Apaches the length and breadth of the territory mockingly sang, "Should auld acquaintance be forgot, and never brought to mind. . . ."

Geronimo lived long enough to become something of a national trophy, a living monument to the submission of Indians to modern American society. He did a good business selling autographed photographs of himself at the Trans-Mississippi and International Exhibition of 1898, and served as a living artifact in an "Apache village" erected on the grounds of the St. Louis World's Fair in 1904. On train journeys, he cut the buttons off his coat and sold them each for a quarter, and then sewed a new set on between stations; his hat went for five dollars. But the aged warrior was never allowed to return to Arizona.

A few years after Geronimo's death, in 1909, the remaining Apaches were living on several reservations in Oklahoma and New Mexico, where they troubled white settlers no more. Ironically, much of the land that the cavalry fought so hard to conquer remains uninhabitable for modern Americans. The heartland of the Apaches "pulses with the absence of the people who knew and used that wilderness best," Roberts writes. "Eighty years on, it seems unfathomable that white Americans could have found no way to coexist, in all the empty magnificence of the Southwest, with a mere twelve hundred Chiricahua–roughly the population today of such wayside Arizona hamlets as Pima or Morenci."

Throughout history, nothing separated Indians and white Americans more than their radically different ideas about land. European settlers believed almost religiously in private property, and that land had value only when it was exploited by the individual. Indians for the most part profoundly disagreed. As early as 1811, the Shawnee chief Tecumseh argued that the only way tribes could stem the advance of fencing-and-farming settlers was "for all the red men to unite in claiming a common and equal right in

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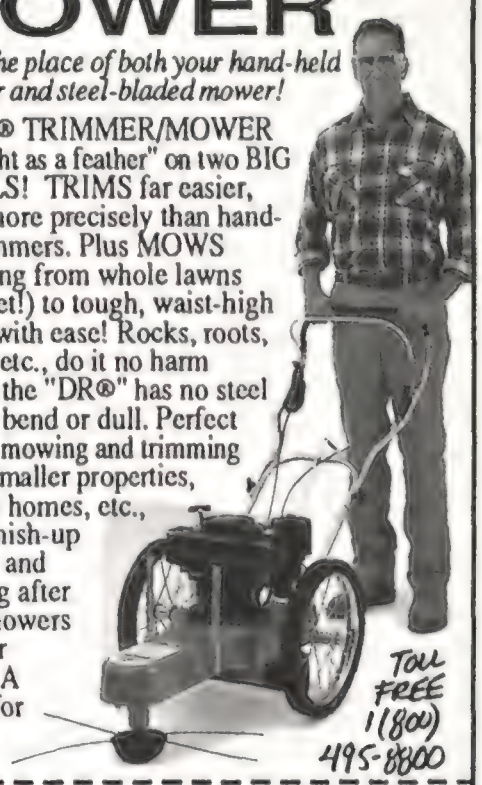

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the land, as it was at first, and should be yet; for it never was divided, but belongs to all for the use of each." Tecumseh dreamed of preserving the traditional way of life intact, but his attempt to form a model community based on Indian principles was swept away by William Henry Harrison at Tippecanoe.

In *Brave Are My People,* Frank Waters recounts the lives of Tecumseh and more than a dozen other chiefs, battle leaders and orators from the history of Native Americans. Some are well known–Powhatan, Pontiac, Crazy Horse–and others less so. Readers will find Joseph Brandt, the remarkable Mohawk warrior who attended Dartmouth and translated the Acts of the Apostles into his native tongue; Sequoyah, the 19th-century inventor of the Cherokee syllabary, the only alphabet independently created in Indian country; Manuelito, the Navajo who led his people in their bitter war against the United States, and then helped lay the groundwork for their development into one of the strongest tribes in the nation; and Chief Joseph of the Nez Percé, whose incredible 1,700-mile running battle with U.S. troops in 1877 prompted Gen. William T. Sherman to declare that they had "fought with almost scientific skill," and had "throughout displayed a courage. . .that elicited universal praise."

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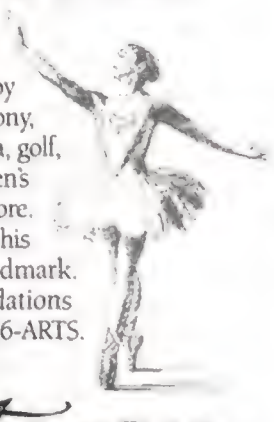

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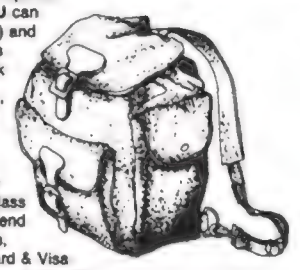

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hand, to gain his confidence; they make him drunk, to deceive him.

"We told them to let us alone, and keep away from us; but they followed on and beset our paths, and coiled themselves among us like the snake. They poisoned us by their touch. We were not safe. We lived in danger. We looked up to the Great Spirit. We went to our Father [in Washington]. We were encouraged. His council gave us fair words and big promises, but we got no satisfaction; things were growing worse. There were no deer in the forest. The opossum and the beaver fled. The springs were drying up, and our squaws and our papooses were without food to keep them from starving."

Waters does not attempt to break any new ground in this essentially introductory book but, rather, provides a series of positive portraits in a plainspoken style. While this approach makes for well-paced narrative, it has limitations, especially when important ambiguities of character and policy are sacrificed to the demands of storytelling. For instance, Waters writes too facilely of Thomas Jefferson wanting to "expand the swiftly growing United States by exterminating Indian tribes." Jefferson, who often wrote admiringly of Indians, in fact believed that white Americans and Native Americans were eventually destined to amalgamate as one people.

Perhaps the book's best-told tale is that of Irataba, the brave and inquiring mid-19th-century chief of the Mohaves. As the guest of the U.S. Government, Irataba had traveled to Washington, Philadelphia and New York, becoming the first of his people to witness the might of the white man's civilization. Upon his return home, Irataba tried to explain to the Mohaves the wonders he had seen and what they would have to contend with as settlement moved westward. "Irataba, the biggest liar on the Colorado!" scoffers shouted, convinced that the white man's cities were but figments of the chief's imagination. Irataba ended his days in oblivion–though apparently unbowed–shunned by fellow tribesmen, tending pumpkins in a lonely corner near the Colorado River. As with so many other tribes since the arrival of Columbus, the Mohaves' shortsighted disbelief, their failure to grasp what they were up against, sowed the seeds of their destruction as surely as did the howitzers of the U.S. Cavalry.

Fergus M. Bordewich is writing a book about American Indians in the 1990s.

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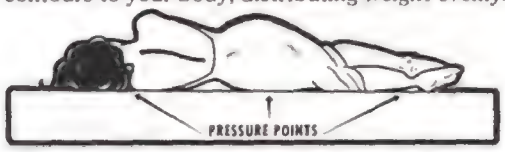

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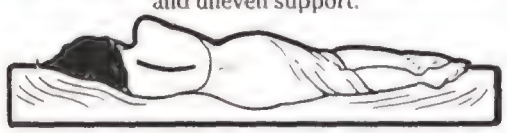

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Broadsides from the Other Orders:
A Book of Bugs
Sue Hubbell
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An Alaska hunting guide I once knew told me that in his view, what this country needed was "more bears, less people, and no bugs at all." Bugs get less respect than coyotes, pit vipers or retired terrorists. We even have a poll on the subject, as Sue Hubbell dutifully reports in *Broadsides from the Other Orders.* The survey (who comes up with these polls?) found that 0.7 percent of those asked had a liking for bugs. Nearly 90 percent were afraid of them or disliked them or both. The other 9 percent–count me in there–were neutral, bugwise.

Hubbell quotes a woman associated with something called the Insect Fear Film Festival on the reason for this phobia: "There is no point of empathy." A professor told her that his problem with insects was that even if he could kill one, which he can't, "another would come, another just like it. And that is too frightening even to consider."

He's right–another would definitely show up. Hubbell doesn't cotton much to quantity questions, but she does note that a swarm of midges, which in its entirety weighs about an ounce, consists of 50 million critters, and that more than a quarter of all the different species that inhabit Earth happen to be beetles.

Hubbell's charm is her easygoing, generous way of gathering and passing on bug facts you had no idea you wanted to know. She's been eyeing insects with something approaching scientific intensity for years at her farm in Missouri, and she treats the subject with dignity and affection–no cheap, stop-bugging-me jokes here. I have the impression she never met an entomologist she didn't like. "Their delight in their subject," she writes, "has the furtive modesty of someone who expects that any time now an adult is going to tell them to stand up, put on dry clothes, and, for heaven's sake, grow up."

Not that Hubbell is a blind, take-no-prisoners insectophile. Discussing the seriously annoying black fly, for instance, she quotes a 1903 writer who allowed that the fly's greatest virtue was that "he holds still to be killed." This might be "unholy joy, perhaps even vengeful," he went on, "but it leaves the spirit ecstatic," much as most of us feel when we draw blood–ours–by sending a mosquito to its reward.

I could have done with a little less

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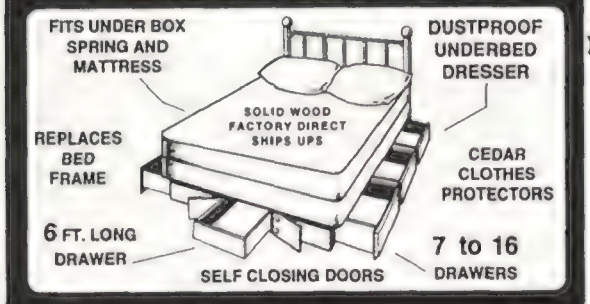
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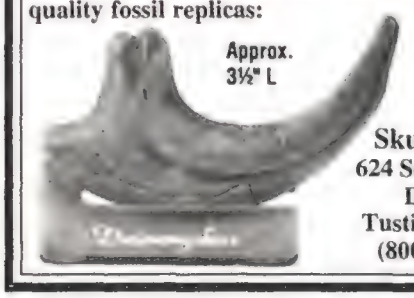

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quoting from multisyllabic journal articles and a little more unholy joy, but Hubbell, in her low-key way, pries out dozens of winsome, whimsical and otherwise engaging bits of bug lore. I was startled to learn that there are people in the California mountains, for example, who make up to $1,000 a day (forgive the quantitative note) gathering ladybugs to be shipped to gardeners as pest removers. I was taken with the Algonquin Indian insect classification system: they divided bugs into biters and nonbiters, identifying the former as *sawgimay*, or "small-person-who-flies-and-bites-so-fiercely." Cattlemen, Hubbell reports, believe that you find a lost cow by checking which way a daddy longlegs' second set of legs is pointing. And I was dismayed to learn that a new strain of gypsy moth, the winged menace that turned June into January in my own woods a dozen years ago, has arrived in the United States from Asia, joining its marauding immigrant cousin from Europe.

The attitude I found most refreshing in Hubbell's book came from the folks in Maine, most of whom both loathe black flies and oppose any efforts to control them. A downhome resort owner explained this seeming contradiction in language I suspect Hubbell endorses: "I prefer my clients to be the sort of people who can accept the out-of-doors the way it really is."

Donald Dale Jackson writes–and keeps the insects at bay–in rural Connecticut.

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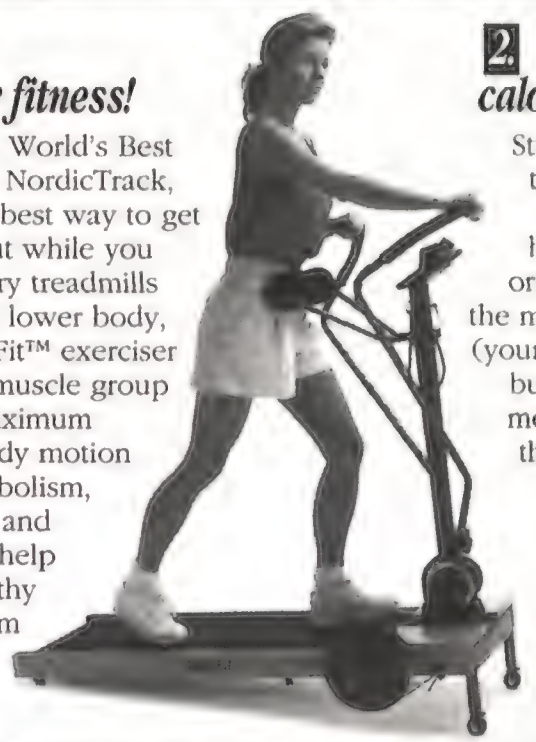

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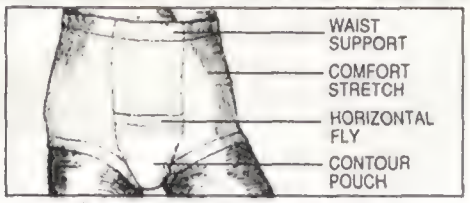

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By Steve Maran

I've got the right name for the Big Bang–and that spells Big Bucks

What a letdown! *Sky & Telescope* admitted recently that, despite receiving 13,099 entries for a much publicized challenge to find a better name for the Big Bang, the judges could not identify a submission worthy of the honor. So the Massachusetts-based astronomy magazine and the rest of you are stuck with this flippant term for the momentous event that, cosmologists say, was the sole beginning of time and space. As it happens, I *do* have the right name for the Big Bang–but more about that later.

The submissions that were passed over for the award ranged from acronyms like BEGINNING (Boundlessly Energetic Gale Involving Nascent and Newly Immature Nuclear Genesis), to vaguely spiritual entries, such as Omniscience Flips the Switch into the Playground of the Souls. There were First Gloop, From Here to Eternity and–we should have known this was coming–Elvis. But the judges just said no.

Since the *Washington Post* revealed *Sky & Telescope*'s embarrassing failure under the headline "'Big Bang' Remains That As Astronomers' Renaming Contest Implodes," reporters hoping to assume the mantle of Woodward and Bernstein are investigating why the challenge failed. After all, this has serious consequences. Professors everywhere are subject to the knowing smirks and titters that sweep the classroom when they bring up the Big Bang in Astronomy 101 (several entries were decidedly collegiate in humor; good taste prevents their inclusion here). And astronomers' neighbors are bugging them about why they can't make up their minds what to call it.

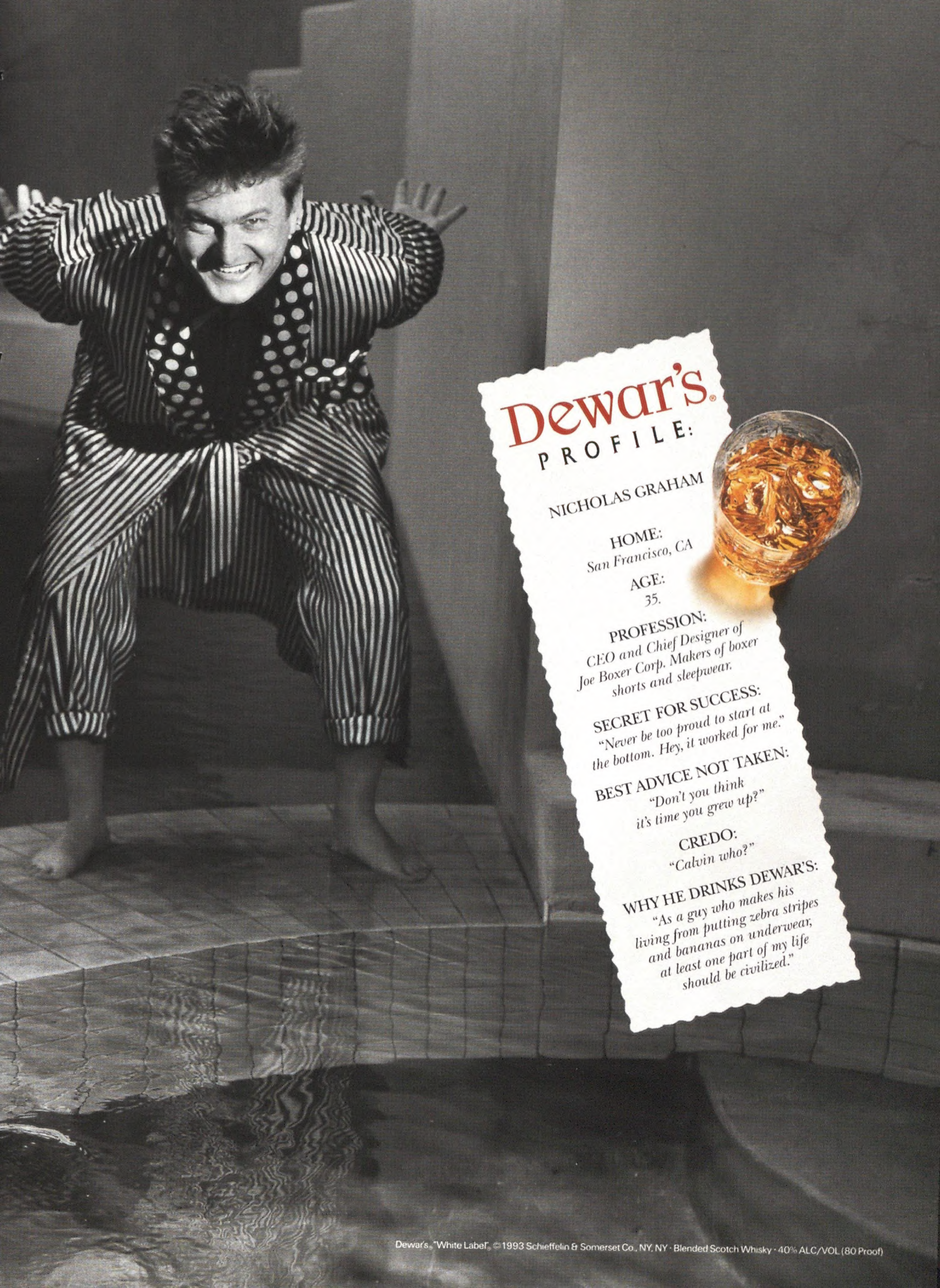
What's in a name? Some say not much. After all, Shakespeare couldn't figure out what his was, spelling it a number of different ways at one time or another, but he's still considered the greatest writer of all time. On the other hand, there's plenty of evidence that the right name does make a difference. Frankly, what leading lady would swoon over an "Archibald Leach"? "Cary Grant" is more like it. No Broadway producer would ever risk a dime on a musical comedy showcasing the dancing talent of "Tula Finklea," but put "Cyd Charisse" up on that marquee and, quicker than you can say "Name that tune," you've got big box office. That's why I didn't enter *Sky & Telescope*'s contest, although I do have the definitive term for the origin of the Universe. There's money in a good name and I want mine! If the Ford Motor Company had called its "billion-dollar investment in the U.S. economy" anything but "Edsel," it might have broken even on the loser of the '50s. In fact, even the "Loser" might have outsold the Edsel. People appreciate honesty.

The pikers at *Sky & Telescope* didn't offer a prize for the challenge, just 15 minutes of fame for the author of the winning entry. Worse yet, all entries became the property of the magazine. Pretty clever, guys! But I'm from Brooklyn and I'm not buying that bridge. Money talks or my great name walks. I'm a writer; I convert words into cash. And I'm not a nickel-a-word guy, either. The pittance paid by *Smithsonian* for a back page like this won't get that name from me. Rename one of those museums on the Mall after yours truly and let us charge admission, and maybe we've got a deal. "Maran's Air and Space Museum" sounds good, or maybe "The Maran Museum of Natural History"–I could make a pest of myself there, at the Insect Zoo.

Otherwise, my agent's going to auction this property. Let *Parade* and *Reader's Digest* and, maybe, *Vanity Fair* fight it out. The winner will get the word when I have safely deposited their certified check. Of course, they get only first North American rights. Every time the name is used again, there's got to be a little circle with an "R" in it, like in Coca-Cola® or Apple Computer®. And we will cut a separate deal overseas, with *The Times* of London, *Paris Match* and the *China Daily Mail.* If PBS airs an update of Carl Sagan's *Cosmos,* I'll have to have a credit, right after Carl's (it can be in slightly smaller type): "With the new name for the Big Bang, by Steve Maran." And they've got to give me a free tape of the show, without the FBI warning, so that I can make copies for all my friends.

Then, astronomy publications can use the word too, subject to my conditions. The profiteers at *Sky & Telescope* won't get off easy. They didn't pick me ('cause I was too smart to enter), but they will pay me. Otherwise they can't print the name, even after it's revealed in *Parade.* But they've got to print it. Who would subscribe to an astronomy magazine that can't even mention the "Xblk Fzzyt"? (Sorry folks, not the real words.) Binocular sales will be off, advertisers will cancel, the magazine's "eclipse cruises" won't leave the dock, and I may just have to cut a deal with their competitors.

They'll settle. First they'll give me their worst offer and call it their best offer. They'll wheedle, bait me with a reasonable royalty, then switch the bid to a meager honorarium. But I know those tricks; I drive a used car, and I've been to mattress stores and discount furniture warehouses. I've spent hard cash to see the hole in the ground at Meteor Crater, Arizona; I've bought "Rolexes" and "Leicas" (no ®s intended) on the street in Rome from men in dark glasses, and I've had the automatic transmission on my car "fixed" lots of times. I'm not falling for anything. *Sky & Tel* is going to come around–they will shell out, cough up and, to put it bluntly, pay through the nose. The right name for the Big Bang is worth it and I've got it–you might even say it was written in the stars.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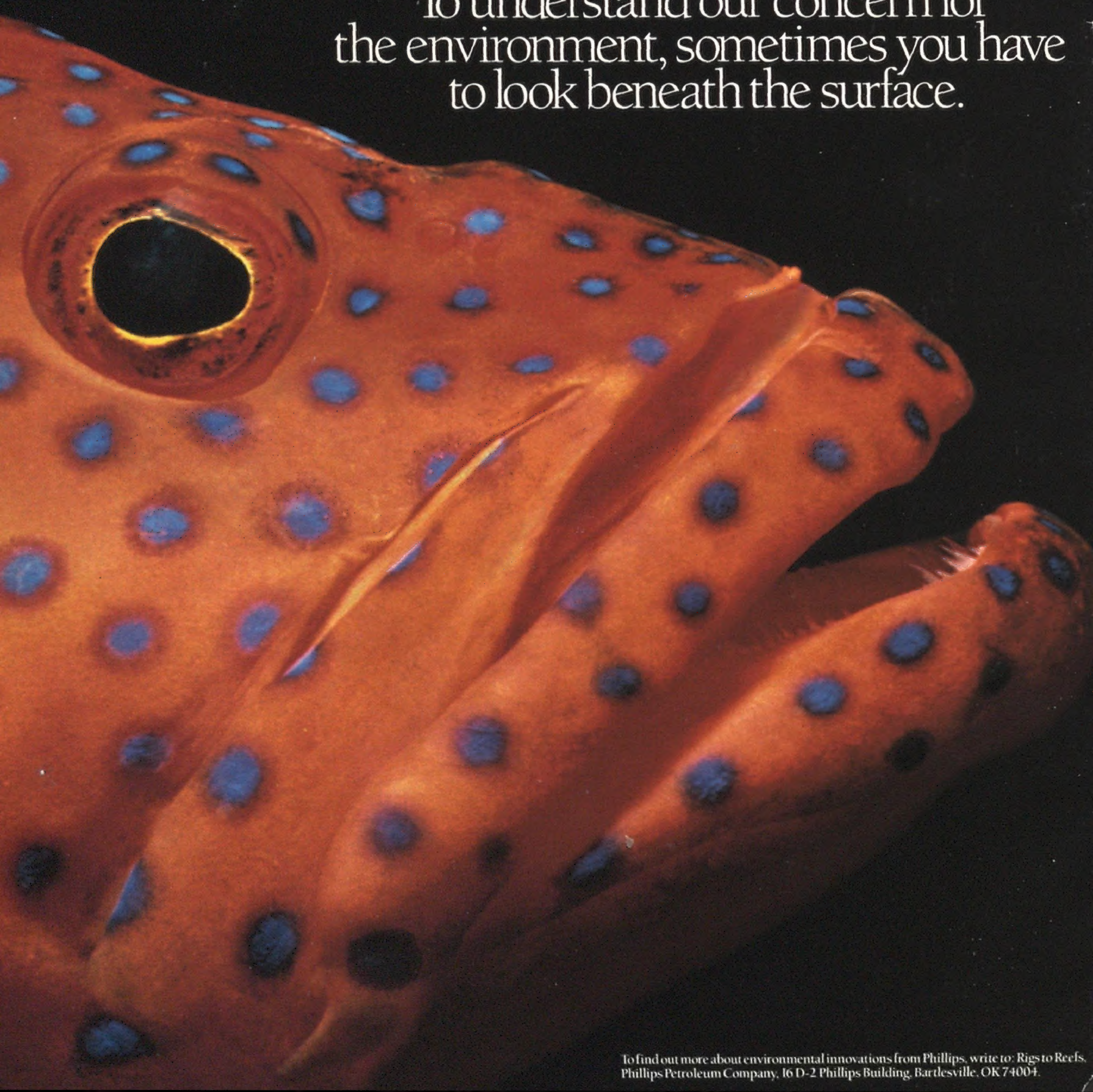

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